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GEOLOGY.

THE BURLINGTON GRAVEL BEDS.

PROF. J. D. PARKER, KANSAS CITY, MO.

In the summer of 1870, while living at Burlington, Kansas, Shell Island, a pleasant summer resort for bathing in the Neosho River, a short distance below the city, attracted my attention. The island was composed of the finest silicious gravel that I had ever seen. Some pieces of chert were of a red variety, while the brown shades prevailed, the gravel in mass presenting a reddish brown appearance that was quite pleasant to the eye. An expert says the color of the chert runs from a light to a dark shade of Italian pink, as oil colors are known to artists. The gravel bed contained a slight detritus of sand with a few bivalve shells, but otherwise had been washed by the river as pure as glass, and formed a royal bathing beach that anyone might covet.

It seemed impossible that such a mass of gravel should be an accidental deposit in the river bed. The query naturally arose—whence the origin of this beautiful chert? Soon a stratum of gravel was discovered outcropping in the river banks. The stratum was traced up and down the river for some distance, and found to vary in thickness from a few inches to two or three feet, but it always presented the same general characteristics. In most places it rested immediately upon the limestone, and was the water-bearing stratum of that locality. In many wells a saucer-shaped chamber was blasted out of the underlying rock as a receptacle for the water which flowed in from the superimposed gravel as clear as crystal. Soon in my rambles, as the gravel stratum was traced up the affluents

of the Neosho River, it was found not to be a mere fluviatile deposit, but to have a wide geological distribution. The chert was found as far south as Oswego, and as far north as Emporia, and persons reported that the same kind of gravel was found in Fall River and in the Marias de Cygnes. But as the greatest development occurred at Burlington, the deposit was naturally called the Burlington Gravel Beds.

Fortunately Prof. Mudge visited Burlington that summer, and we examined the beds together. He said the deposit was the result of glacial action subsequently modified, and might be termed modified drift. The sharp edges of the gravel left from original fracture had disappeared in the ceaseless roll of the primal ocean. Still the hardness of the chert, which struck against a file gives forth a stream of fire, had resisted to a large extent the friction incident to the ocean. He thought the gravel would prove of value as a macadam for streets, and as ballasting for railroads. The results of our examination were embodied in a paper which was read before the Kansas Academy of Science at the autumn meeting.

Since the discovery of the beds in 1870, I have tried to bring the value of the gravel as a macadam to public notice. Mr. N. P. Garretson of Burlington, sent by request a sack of the gravel to Kansas City for examination. General George H. Nettleton caused several car loads of the gravel to be transported to Kansas City, and put into the walks at his residence to test its properties for this purpose. Mr. Robert Gillham, a civil engineer of Kansas City, was induced to visit Burlington last year to examine the beds. His conclusions were so favorable that he read a paper on the subject at the last meeting of the Kansas Academy of Science. He estimated that Shell Island contained 1500 car loads of gravel. I find the island at low water is 150 paces in length by ninety paces in width, forming an irregular oval, and the deposit is six to eight feet in thickness above low water-mark, and may extend several feet below it. And the freshets bring the gravel down the river perhaps as fast as it can be used. But the geological stratum underlies the whole region, and in the extension of the Kansas City, Burlington & Santa Fe Railroad, it will probably be laid bare in cuts for miles where the gravel, which lies near the surface as we go west from Burlington, can be shoveled immediately upon the cars. In one of the affluents of the Neosho River, three or four miles southwest of Burlington, I found the gravel stratum, outcropping in the banks of the creek near the surface of the ground, about four feet in thickness. The railroad, I noticed, has also laid bare the gravel deposit in many cuts between Burlington and Williamsburg, and Mr. James Houston, Division Superintendent of the Kansas City, Burlington & Santa Fe Railroad, reports a hill of gravel near the railroad track this side of Burlington.

This gravel has been laid upon the streets of Burlington as a macadam, for several years. Laid immediately upon the ground, however, it has lacked a solid foundation to support the pressure to which it has been subjected in wet weather particularly in the spring, when the ground is soft and porous.

The heaviest wagons would at such times cut through the macadam, mud would be transported by the wheels upon it, and the gravel has had a tendency

in wet, muddy weather to roll up in masses along the road. The fault does not lie, however, in the gravel, but in the lack of a firm foundation of stone. During dry weather the gravel packs and forms a solid macadam as smooth as a floor, and under the roll of wheels rings like iron. The silex containing oxide of iron fractures and powders a little under the grinding action of wheels, but does not crush, and this with a little sand contained in the gravel is sufficient for packing purposes. Burlington probably has the finest macadamized streets, and the best well water, of any town in Kansas.

To gravel a street, or in the language of engineers to lay a Telford road, there needs first to be made a stone foundation inclining a little both ways toward the gutters to drain off the water, and this should receive a dressing of gravel from four to six inches in thickness which should be rolled down smooth with a heavy iron roller. Our native limestone laid on its edges makes a good foundation. With proper repairs such a road of gravel would last a generation. I am inclined to think the gravel may not withstand the wear and tear of our heaviest business thoroughfares like Fifth street, but for residence streets, and lighter business streets, the gravel would be durable and beautiful. If Penn street could receive such a dressing of gravel it would become one of the most charming streets in the west.

Such a graveled street would form a striking contrast to the dressing of native limestone which is now laid upon the streets of Kansas City. The broken limestone is soon ground to powder and turns into dust and mud. The people of Kansas City exhibit, however, a persistence of purpose and action in this respect, worthy of a better cause. When one dressing of limestone stone blows away in the equinoctial gales and disappears, they immediately commence to lay down another. Thus one dressing succeeds another as the seasons come and go, even the leaves of the forest scarcely strew the ground more regularly from year to year, than are limestone dressings laid upon the streets of Kansas City. And all this toilsome and expensive work is carried on amidst discouraging circumstances, clouds of dust filling the air, and rivers of mud at times running down the streets —still the people are not disheartened. Gradually the bluffs melt away while the houses are filled with dust and the streets rendered almost impassable; still the stone hammer breaking limestone may be heard under the bluff, and for aught that now appears, may continue to click to the end of time. Such persistence in any people is worthy of special notice.

The broken limestone now laid upon the streets of Kansas City is also injurious to public health. Under the friction of wheels the limestone is soon reduced to powder, and fills the air with a fine dust which in dry weather is almost insufferable. A wagon passing down Broadway during the late dry season was almost hidden from my view, fortunately the heads of the occupants of the wagon appeared above the cloud of dust to show where the wagon was. This fine dust enters the lungs at every breath as a foreign substance to induce disease. A physician informs me that he was compelled during the late hot weather to close the windows of the room on the side of the avenue to shut out the dust, and to

use an atomizer to settle the dust in the room, before his patient, who had a bronchial disease, could find any rest or relief. In the minds of those who are best informed on this subject this single objection would be sufficient to exclude the limestone as a dressing for our streets.

The limestone dressing is also objectionable in its injurious effects upon the eye. The white glittering light reflected in a bright sun from the freshly broken limestone is very trying to the eyes. Persons whose eyes are not very strong cannot endure it, and turn away for relief from the glittering light. A surgeon informs me that during the late war while in camp on the white sands of Florida he blackened the tents of the soldiers and thus emptied his hospital of patients having sore eyes, while the hospitals of those regiments whose tents were white-washed were full of patients from sore eyes. The census of 1870 reported over 20,000 blind persons in the United States. If we count the pur blind, and those who cannot see to read, this number would probably be more than doubled. The estimate at the present time is placed as high as 50,000. Certainly no intelligent people would multiply the causes of blindness. They would not spread their streets from year to year with a substance whose optical effects are recognized by the best authorities as highly injurious.

It only remains to speak of the supply and cost of the Burlington gravel. Captain Trowbridge has kindly furnished me some estimates on this subject, published with this paper, which I think can be reduced considerably. As the foundation of stone will be the same with the gravel and broken limestone dressing, we can drop it out of the estimate. The cleanly washed gravel from Shell Island can be purchased, I am informed, at fifty cents a royalty by the carload. But the stratum of gravel underlies the whole country, and west of Burlington in many places it lies on the very surface, sometimes nearly four feet in thickness, and can be obtained in unlimited quantities. The beds only need to be developed, and can never be exhausted. Gravel also exists in large quantities in the Marias des Cygnes. The railroad now offers to bring the gravel from Burlington to Kansas City for $15.00 a carload, and it is thought it can be brought in large quantities at $10.00 a carload. Now if it will last ten times as long as the limestone dressing, and judging from the Burlington macadam, it would with proper repairs last a generation, we can easily see in the long run how much cheaper it would be than the limestone. And the fact that the limestone is now broken without expense to the city does not avail as the same force can be employed in putting down the stone foundation, and thus free labor from the work-house made of some profit to the city.

I have submitted packages of the Burlington gravel to various experts, and herewith publish their opinions:

Prof. C. F. Chandler, chemist of the School of Mines, of Columbia College, New York, writes: "In reply to your letter I would say that the sample of gravel you sent me seems to be *admirably* adapted for macadamizing."

Dr. John Fee, city physician, with whose writings in reference to the eye and color blindness the public are familiar, writes: "The limestone that is broken and placed upon our streets as a macadam has a white, glittering appearance that is quite trying and injurious to the eye. I should regard the chert from the Burlington Gravel Beds as a great improvement to the limestone in its optical effects."

Dr. T. J. Eaton, chemist of the Kansas City Medical College, writes: "I have examined the sample of chert (or Burlington gravel). It seems to be one of the sub-varieties of the numerous quartz family. It has the colors of jasper, the hardness of flint, but a little more brittle than the latter. Its physical and chemical properties render it one of the best macadamizing agents known. Its hardness would make it durable. Its color is easy on the eye. Its brittleness is just right to make it pack properly on streets that are much used. While mixed with a small proportion of our best limestone, it would pack all right for residence streets. I hope to see a test made of it on some of our streets in Kansas City. If it proves practically what it promises theoretically, and the cost of getting it here is not too great, it will soon supplant the miserable stuff we are now spreading on our streets.

Capt. J. M. Trowbridge, late city engineer of Kansas City, writes: "From such very limited samples of the Burlington gravel as I have seen, I am of opinion that the wearing qualities are of the highest order. It is a silicious gravel made up principally, so far as my limited opportunities of observation go, of jasper, and other kindred minerals, differing principally in color though not in texture or in hardness. Besides being hard it is tough, quite as necessary a quality for a pavement as hardness. It resists a shock or concussion as well as it resists abrasion. This quality will be better understood by comparing it with glass. Glass is hard, but it is fragile, reduces to powder easily, and if available, would be unsuited to paving purposes on that account. So with a certain silicious strata in the limestone of Kansas City. It is quite hard, and flinty in appearance and characteristics. It resists the drill, but spoils or chips with the utmost freedom, and would reduce to sand or wear out under the traffic of our streets with great rapidity. The Burlington gravel would do neither.

"Again its general shape, flat and thin, rather than round or cubical, gives it additional value for this purpose. It were easy to show, both theoretically and practically, the value of that form, but I need not lengthen this note for that purpose.

"There are in my judgment only two questions concerning this material; those are cost and binding, or cohesive qualities. Some gravels, as that at Cape Girardeau, possess this binding property in an eminent degree. Thrown loosely upon a grade, it packs very quickly into a compact solid road-bed. Others though hard and tough fail in this quality, and never give a compact surface. Perhaps this question is already favorably decided by the trials at Burlington, where, I understand, it has been in use for years with satisfaction in this respect.

"Concerning cost here I have very grave doubts—not but that it *could* be afforded cheap enough, but because it would be so nice a thing to be (virtual) sole proprietor of the only available material for paving a prosperous, thriving but muddy city of 75,000 inhabitants.

"I append a few notes of approximate cost drawn from correspondence on the subject a year or two since. Under the most favorable circumstances, no less a thickness of gravel than four inches will answer. Assuming that our cheap limestone has been used to sheath over the road-bed. With a sixty foot street, two twelve-foot sidewalks and two six-foot gutters, there remains twenty-four feet of road-bed for traffic, and consequently to be graveled or paved. Twenty-four by one-third feet, equal eight cubic feet per running foot. Eight cubic feet of this material will weigh fully 1,000 pounds, and a carload of 24,000 pounds will dress just twenty-four feet in length. I understand that this gravel will cost say per carload (7 cubic yards) $3.50 in the bed; $2.00 for loading; $15.00 for transportation from Burlington to Kansas City, and $7.50 for hauling and spreading on street. Total $28.00, besides cost of paving and grading, say fifty dollars more, making all told about $80.00 per twenty-five feet front by twenty-four feet wide."

Robert Gillham, civil engineer of Kansas City, writes: "I visited Burlington by request and investigated the gravel beds. My examinations embraced a large portion of the surrounding country. Outcroppings may be found along the banks of the Neosho River, and creeks emptying into it. In my opinion the beds cover a large area, having traced it as far south as Oswego, and as far north as Emporia. It can be seen present in many cuts along the railroads in eastern Kansas and western Missouri. The gravel at Burlington varies in depth below the surface, and several miles west of the town it may be seen at the surface.

"The maximum depth as found by the tests resorted to, was sixteen feet below the surface and will probably average nearly three feet in thickness, and is usually the water-bearing stratum throughout the surrounding country. When property owners, in sinking wells, meet the gravel they are sure of water possessing most excellent qualities.

"In the Neosho River at Burlington large beds have been forming for a number of years, the gravel being transported from creeks and rivers emptying into it, during high water. These beds of gravel are available in quantity, and may be shipped to any point by rail.

"The gravel may be used successfully on residence streets in any town or city, and laid at a very small cost. The street should be excavated to the required depth and width, a good foundation of broken stone laid, followed by 4" of pit gravel well rolled, followed again with another layer, and so continue until sufficient covering has been used and the whole becomes hard and compact.

"With proper care the Burlington gravel will give great satisfaction in making streets and roads, which will be more durable than the ordinary macadam road. I am fully convinced that these gravel deposits are valuable, and may be developed with profit. Geologically considered the beds are doubtless modified

drift, having been modified during subsequent geological changes, breaking up and entirely changing their original depositions and distribution."

In gathering material for this paper, I wish to make grateful acknowledgments to Gen. George H. Nettleton for railroad courtesies, and to Messrs. Scott, Grimes and Garretson, of Burlington, for special favors fitted to gladden the heart of a scientist.

ORIGIN AND USES OF ASPHALT.

BY LEON MALO, C. E.

Bitumen appears in nature as an accidental mineralogical product, under the the most diverse and often most inexplicable conditions. It is found sometimes in the native state, sometimes mixed with clays, sometimes as the cement of conglomerates, sometimes impregnating limestones. The last combination produces the mineral commonly called asphalt. When the bitumen contained in any of these substances is chemically isolated, it appears always a nearly identical substance, in composition, consistency, and appearance, except that the empyreumatic odor that characterizes it may become alliaceous in volcanic countries. Asphalt is doubtless one of the most considerable and valuable of the forms in which bitumen appears. It is a soft limestone, naturally and closely impregnated with that substance. When a specimen of it is examined under the microscope, each grain of it appears to be immersed in a pellicle of pure bitumen, by which it is cemented to the adjoining particles. It is thus a species of very fine-grained bituminous conglomerate. When a lump of this rock is heated to a temperature rising from 176° to 212°, the pellicle of bitumen melted, the cohesion of the asphalt is destroyed, and it crumbles into dust. If it is taken while it is still hot, or if it is heated again after it has become cool, and strongly compressed, the particles will adhere again, and the stone will recover, after cooling, precisely the consistency and appearance it had originally. The employment of compressed asphalt for pavements is founded on this property.

Asphalt, or bituminous limestone, is generally found in the Jurassic strata, in regular beds of a lenticular shape, which are uniformly cut into by a stream of water. Sometimes the bed is single, at other times it is multiple ; there are formations containing seven beds, one above the other, and distinctly separated by strata of white limestone.

Different views prevail respecting the origin of asphalt and the circumstances under which it is formed. Some believe that the bitumen was already in existence when the calcareous formation took place, and that the particles of limestone were deposited in a bituminous sea. Others consider that the bituminous matter is derived from the organic matter associated with the shells that have furnished the carbonate of lime ; and other more hazardous hypotheses have been advanced.

A careful observation of asphaltic formations has led me to adopt what appears to me to be a more plausible theory.

It is permitted to suppose, from indications furnished by the study of bituminous districts, that in some geological epochs, which have yet been only imperfectly determined, accumulations of organic matter, buried under enormous masses of Jurassic limestone, and heated by the central fire, became vaporized, and in that condition sought a passage through the crust of the earth. In time the crust cracked, and a fissure was formed. The bituminous vapors, compressed by incalculable pressure, forced themselves through the way that was opened to them, and passed by such strata as were too compact to be penetrated; but, when they reached the oölite, they found on either side of the fissure, beds of a limestone soft enough to admit of their impregnating it. As long as the pressure lasted, the bitumen continued to insinuate itself through the pores of the limestone, and to fill its infinitesimal cavities.

Mineral asphalt is relatively a soft stone. It becomes more compact as the temperature diminishes, but yields under the influence of heat to such a degree that an exposure of a few days to the summer sun will sometimes cause it to crumble. This property has induced the application of the compressed material to the making of pavements. Its fitness for this purpose seems to have been suggested by accident. When the mineral was first quarried, the pieces which fell along the road from the wagons carrying it were ground up by the wheels, and were finally compressed again by the continued passage of the wagons over the dust, so far as to form a kind of spontaneous pavement. A Swiss engineer, M. Mérian, acting upon the suggestion of this incident, asphalted a part of the road from Travers to Pontarlier, in a rough way, but with a satisfactory result. In the next year (1850), M. Darcy, inspector-general of bridges and highways, recommended asphalt as a material for pavements in a report to the Minister of Public Works. The first asphaltic pavement was laid in Paris in 1854.

The mineral appears in industry, under a still more useful form than the compressed form, as asphaltic mastic. This is made by throwing the powdered mineral into a bath of seven or eight per cent. of its weight of liquid bitumen, and mixing the whole thoroughly while it is cooked for five or six hours. The substance produced, although chemically the same, except for the difference in the relative proportions of bitumen and limestone, is physically entirely different from asphalt. It cannot be pulverized by heating, but forms a paste in which the two ingredients seem to be perfectly combined, and which may be molded into desired forms. The manufacture of the mastic has become an important industry. The annual production of the French shops alone must amount to fifteen or twenty thousand tons.

In "La Nature," of April 9th, Mr. A. Woeikofen, of St. Petersburg, describes the asphaltic beds of Russia, which occur on the grand curve of the Volga, or the arc of Samara, a short distance above the city of Syzran. They are not deposited in the Jurassic formation, as are those in France, Switzerland, and

Germany, but in a dolomitic limestone of the lower Carboniferous series. The mineral is rich in bitumen, of less fusible quality than the bitumens of France and Switzerland, and has not been produced in the compressed form. It is extensively made into mastic, the fabrication of which already amounts to ten thousand tons a year, and is rapidly increasing.—*La Nature.*

ANTHROPOLOGY.

THE STUDY OF MANKIND.

BY ALEXANDER WINCHELL.

* * The science of man in its broad sense is understood to embrace the comparative anatomy of races, their intellectual, moral, social, religious and industrial conditions, and the progressive development of modern conditions out of primitive conditions. The search for primitive conditions leads us into the field of archæology, both historic and prehistoric. The study of the evolution of modern conditions necessitates the discovery of the organic principles of sociology and religious life; and the special operation of these principles among the several varieties and conditions of mankind, united with the structural characteristics of races, brings into requisition the whole of the well recognized science of ethnology. Anthropology, in this broad and just, and important sense, is a new science, constituted during the lifetime of the present generation.

It is this science which Mr. Tylor undertakes to pioneer into popular favor and acquaintanceship. His researches and writings for many years past have given him a masterly familiarity with the sociological, industrial and religious aspects of humanity in primitive conditions; and if he is not an equal master of ethnology and archæology, he is at least a fit person to offer the general reader this Introduction. The field of anthropology is vast, and the present work attempts little more than to guide the reader to its borders and point out its extent and attractiveness. A happy preliminary chapter affords a conspectus of the materials and methods of investigation. It directs attention to the familiar facts of racial, linguistic, and cultural differentiations, on which may be based well-known inferences concerning the laws of divergences, and the high antiquity from which they must have proceeded. The body of the work begins with a comparison between man and the lower animals in respect to bodily structure and psychic powers. Mr. Taylor is quite positive that the higher attributes of man are possessed in the germ by some of the orders beneath him, holding that even lower animals have the faculty of forming some of the simplest abstract conceptions. The chapter devoted to human races, while neither full nor original, is copiously illustrated by fresh and telling portraits which supply large deficiencies

of text. Mankind are regarded as one species zoölogically, and the races are considered as different "breeds." The white race is the last differentiated. A black type once stretched from Africa to the Philippine Islands and New Guinea, and is still represented by Negroes, Mincopies, Aëtas, and Papuans. Man is thought to have appeared in the New World and the Old in a geological period earlier than the present, perhaps a time "when there was no ocean between" "the Mongols and the North American Indians."

Languages and their progressive differentiation are treated with considerable fullness of illustration, from the rude sign-and-gesture language of lower animals and children to articulate language and written signs or ideas and of speech. Imitative gestures are the natural language of the simplest human condition. The first vocal utterances are emotional and most inarticulate. The next stage of articulate speech is chiefly imitative, and hence very similar words occur in widely distinct languages. We employ the term articulate to denote the articulations or joints of a vocal sound, effected by the alternation of vowels and consonants; though Mr. Tylor applies it, unadvisedly, we think, to the joints of a sentence. The author's view of sentence-building and its progressive development is intelligent and sound. As to the relation between language and race, he is wise in pronouncing it an uncertain criterion of ethnic distinctions. Generally, people of one ethnic stock speak one or more dialects of one original language; but manifestly some, by captivity, by neighborhood of a superior race, or by other causes, may be led to employ a language unknown to their ancestors. Yet affinity of languages must always be assumed as evidence, *prima facie*, of ethnic consanguinity. The linguistic stocks of the White race are mostly Aryan and Semitic. The Egyptian language, either by absorption or inheritance, possesses many Semitic elements. No success has been attained in the effort to trace Aryan and Semitic languages to an older parent tongue. The Tatar nations speak languages of a distinct family. The Chinese and Indo-Chinese show obvious kinship, though after a long process of differentiation. The Chinese and Siamese languages are far removed from a *primitive* condition. Though possessing monosyllabic and grammatical simplicity, this is rather the outcome of long attrition and disintegration than of a formative stage. The Akkadian tongue, spoken by the first settlers of Babylonia, "shows analogies which may connect it with the Tatar or Mongolian languages." We would suggest, however, that this does not show the primitive Babylonians to have been Mongoloids, since, as we believe, the Akkadian tongue was Hamitic, and acquired Tatar elements only through contact with subjugated aboriginal Mongoloids, who were the predecessors of the White race in all Western Asia. Another family of languages is the Dravidian, of India. The Polynesian Blacks, whether racially connected with African Negroes or not, speak languages which stand apart, and constitute a separate family. In South Africa the great body of Blacks speak Bantu languages, though the Mandingoes stand apart. The speech of the Hottentot-Bushman is also fundamentally distinct. In America, linguistic diversification has been carried to a great extent, and a number of distinct families must be recognized. All the languages of the

world may be reduced, perhaps, to fifty or one hundred families. Little progress has yet been made in tracing these to one or several ancestral stocks. The author's account of the development of writing is brief, but admirably presented.

In approaching the subject of the arts of life, Mr. Tylor is on ground perfectly familiar to himself, and which he has made familiar to the reading public through previous volumes and numerous memoirs in the ethnological and anthropological journals. No man is able to speak with higher authority. It is not surprising that he has given his favorite and most familiar themes the amplest development in this volume. One unacquainted with the author's previous publications may find the gist of them in these chapters and the following. We find here, for instance, elementary statements of the evolution of many of the implements and mechanical combinations of civilized life, such as spears, axes and knife, wheel-carriages, mills and plows, methods of hunting, fishing, and war, dwellings, personal ornamentation and clothing, navigation, cookery, pottery, metal working, money, and commerce. These subjects have been separately elaborated by the author, at adequate length, in the anthropological journals; and the reader is here furnished outlines and conclusions from investigations of new and striking interest. On the development of the arts of pleasure and the sciences the author has been equally happy and original.

One of the characteristic doctrines of the author, and one largely elucidated in his previous works, has been designated "animism," and this subject is treated with relative fulness in the present work, in the chapter entitled "The Spirit World." Mr. Tylor entertains the opinion that the idea of the soul is the foundation of all savage religions. Savages universally believe that the soul may exist and act independently of the body. The souls of the dead continue in existence, and frequent their former abodes, and possess some power over the fortunes of their surviving relatives. Souls, which are otherwise contemplated as spirits and demons, may be moved by good or by evil motives. They bring prosperity or sickness and misfortune. Men, therefore, begin to propitiate them. The souls of ancestors acquire higher and higher dignity, and are held in ever increasing reverence. The souls of great chiefs and warriors assume a divine character. Their names become the names of gods. Thus the Mongols worship as good deities the great Genghis Khan and his princely family. "The idea of the divine ancestor may even be carried far enough to reach supreme deity, as where the Zulus, working back from ghostly ancestor to ancestor, talk of Unkulunkulu, the Old-Old-One, as the creator of the world." This is the extreme development of animism. The theory is highly ingenious and we have an enormous array of facts which admit of coördination under it. There is, we believe, much truth in the doctrine; but our own study of comparative religion leads to the conviction that the savage notion of a supreme being is not the outcome of any animistic tendency, but a gift incorporated in the constitution of the psychic nature of man. We are inclined to think that it is the initial rather than the final term in animistic progress. This intuitive notion of an invisible Supreme suggests the notion of invisible powers of lower orders. In man is an invisible and powerful entity;

in the tree, in the sky, in the sun, are other powerful existences, all kindred with the spirit which sustains the universe, but inferior, and generally subordinated. Mr. Tylor argues that religious anthropomorphism confirms this doctrine of the evolution of gods from human souls. We think, on the contrary, that the barbaric notion of divine being and power is anthropomorphic; for the simple reason that "man is the measure of all things," and is compelled to think divinity in terms of humanity. Mr. Tylor travels over familiar ground in his concluding discussion on the beginning and development, significance and relations, of history and mythology, and on the organization of society.

We have no space for any fuller analysis of this work, for which the public are under great obligations to the author and the American publ sher. It deserves high commendation. Its drawbacks are few and not serious. We do not think the author has given a justly proportionate development to the physical characteristics of races, and their relations to the regions which they inhabit. Ethnology is subordinate, and *man* is the central idea of the work. We can anticipate the justification of this mode of treatment; but we think *man*, attentively considered, leads our thoughts down to racial distinctions, race origins, chorographic relations, and ethnic movements. We think, too, a treatise on anthropology might well give a fuller view of prehistoric archæology, even to the omission of some of the copious illustrations of language-formation and the arts of life. The work aims to be elementary, and for this reason, undoubtedly, some matters were abbreviated, and others almost om tted; but it is hardly symmetrical. It seems ungracious to make even these exceptions to its excellence; but we must permit ourselves also to express discontent at the author's manifest effort especially in the earlier chapters, to write in a very simple style. He has merely fallen into the use of expressions which are needlessly inelegant and ungraceful. Thus, in several places he speaks of "the lie of the land." Other objectionable expressions are "the un-English looking group of animals;" "man's being the tool-using animal;" "traces of the letters having been made;" "anyone who happens to have been up country in America." These errors of form, however, are venial, and we welcome to our literature, in this work, a contribution which is a substantial and creditable addition.—*The Dial.*

THE SACRIFICIAL STONE OF THE CITY OF MEXICO, IS IT GENUINE OR NOT?

BY EDWARD PALMER.

In the city of Mexico are offered for sale, casts in plaster of the so-called sacrificial stone now in the courtyard of the museum in the city Mexico, of which much has been written to prove its genuineness. These casts are much reduced in size, and do not contain the groove of the original. The maker, like many of his countrymen living in the city of Mexico, may not believe in the genuineness

of this stone's history; many assert that it was not the sacrificial stone of the Aztecs used in the city of Mexico. No doubt the basin in the center, and groove running from it across the top and down the sides were made after the ornamentation was completed. As this is claimed to represent the journeying of the Aztecs to the city of Mexico, why did they not cut the groove first, then the historical representation? As it is, the figures through which the groove is cut, are partially effaced. The groove was evidently cut after the completion of the stone, and in a very rough, uneven manner, passing through the figures in order to give a false importance to a carved stone, which, if allowed to tell its own tale, or, rather, if its history had not been destroyed so as to attach a false representation to it, would still be a valuable monument.

One would think that an object designed for so important a purpose, would have been dressed into shape at the same time, without having to pick up an accidental stone and improvise it for an occasion. If the figures on the surface represent the journeying of the Aztecs to the valley of Mexico, then it did not take many to form the procession. Is there not a great probability that this so-called sacrificial stone had a useful purpose? We are led to this conclusion by seeing scattered about many large round stones, both plain and ornamented, yet without grooves. In the old mills of the early Spaniards, are to be found the very counterparts of these. And why did the Indians want a stone with a hole in it, to retain the heads of prisoners as they were severed? A round object allowing the head to hang over so as to bare the neck for the knife, would be better adapted for the purpose, than to lay the head in a hole with the neck contracted. Is it proved that the Aztecs cut off the heads of their victims? All the stone knives the writer has seen with edges of sufficient length, strength and sharpness, would be poor, slow tools for the cutting off of the numerous heads said to have been daily removed by Montezuma. In the collection of antiquities are several obsidian knives marked "sacrificial knives used by the Aztecs," all of which are better adapted to cut off the tops from turnips and carrots, than human heads, especially if bones were suddenly hit, as the brittleness of these knives would be their speedy destruction. If these so-called Aztecs burnt their dead as a national custom, why accuse them of cutting off human heads to appease their gods? It was only giving the Spanish priests a pretext to call them idolators; so they called it sacrificing human beings. It was good religious capital to work upon. One proof of their burning their dead is, that no graves have been found in the country they occupied, that are older than the Spanish conquest. The Chichimecs, called Aztecs, could not cut off the heads of all their victims; some would die. Why are they not found? There are three skeletons in the museum of the city of Mexico, which were obtained in the old Inquisition building of the city, of those who were starved to death because of their refusal to yield to church dictation. They find no bodies because they were all burnt according to custom, a usage continued to the present day by their kin the Apache, the Yuma, Mojave and others,—plain, simple Indians, not fond of the pageantry

attributed to them by the conquerors, who must fictitiously give them importance in order to throw reflected greatness upon their conquest.—*American Naturalist.*

ANCIENT PUEBLO WORKSHOP.

BY E. A. BARBER.

On the north bank of the Rio San Juan, in Southern Utah, about twenty or thirty miles below the mouth of the Mancos cañon, in the summer of 1875, I discovered the site of an ancient aboriginal workshop, where axes and hatchets had formerly been made in large numbers. On an elevated ledge overlooking the river, I gathered together in the space of half an hour, upwards of twenty stone axes of various sizes and in different stages of manufacture. They were all made of the natural, rounded, water-worn stones of the river, such as we call cobble-stones, varying in length from four to ten inches. As a general thing, the flat stones, which approach most nearly the desired form, had been selected, and the majority of them had simply a groove roughly chipped out around one end. None of the specimens exhibited any traces of surface-pecking. In some examples the edge had been commenced by flaking off small fragments on each side, whilst a few had been superficially sharpened by abrasion. One highly polished celt, of the long, narrow variety, such as the one figured in Hayden's Report for 1876, Pl. XLVI, Fig. 3, and two or three broken specimens were included in the series. They were all found on the surface, scattered through a large number of stones which had evidently been carried there for the same purpose. The ledge or small plateau on which they were found, did not exceed two hundred feet in length and fifty in width.—*American Naturalist.*

THE NEGRO AS AN IRONWORKER.

The *Iron Age* in discussing the value of the negro as a worker in the manufacture of iron, says:

"For some years a portion, at least, of the workmen at the Old Dominion and Tredegar Iron Works, at Richmond, Va., have been colored men, and as puddlers they have been especially efficient. Some years ago, during a strike at a mill in Pittsburg, a number of colored men were brought from Richmond to Pittsburg as puddlers, and unless a change has been made very recently, the puddling at this mill is still done by negroes. These experiments and their results, successful as they have been, have not been generally known in the South, and when some six months or more ago the Knoxville (Tenn.) Iron Works concluded to try negro labor, it was with some doubt as to the result. To-day, we are assured, the mill in all its departments is run entirely with negro labor—puddling, heating, rolling, shearing, etc. The superintendents are white, but heaters, rollers, roughers, catchers, drag downs, puddlers, helpers, etc., are all color-

ed. At the Atlanta, (Ga.) mill a similar course has been pursued for about two months. The puddling is done by colored labor as well as it was done by white, and as soon as men are taught, the remainder of the work will be done by them. In every case, we are informed, the negro workmen are as efficient as the white."

And in discussing the same subject the Philadelphia *North American* says:

"* * At this moment the negro is the black sceptre through which the South can rule the land. * * The one thing which holds back this country in its wonderful career of development and prosperity and retards its progress is the want of labor. * * The South to-day controls the labor field of this land, and the power which enables her to hold that commanding position is the negro. Under the crucial strain of the last two years our contractors and companies everywhere have been trying every possible expedient to find and hold the labor that they must have. They have tried the men of every race, creed and color, and with remarkable unanimity their judgment is settling down on the negro as the most available and desirable and economical for the rough work of railway construction, mining and tunneling, *i. e.*—the foundation of labor. This is a judgment that has been established by fact, by the patient, silent experiment of years. In the course of inquiries we find that large bodies of negroes from the South have been taken up to Pennsylvania and New York by contractors, worked there for months and returned to their plantation homes. Seven hundred negroes from around Staunton, Va., are now working in one company's mines in Minnesota. A Pennsylvania contractor is now in Colorado negotiating with one of the most vigorous and prosperous railways there for a contract on which he expects to take out and work 2,000 negroes from the far South.

"While the negro may not have the physical stamina of some of the hardier races, he has moral qualifications as a laborer which bring the results of his labor up to their level. He is patient, steady, faithful. if well treated, and trusting. He does not waste his force in strikes or sprees, and his saints' days do not seriously encroach on the volume of the calendar. * * Short of China, the labor field of the world, for us, at the present moment is barren and limited. This is the South's great opportunity. Labor, the foundation of all values, is her staple. The negro, an economic burden under slavery, under freedom has become her chiefest treasure. * * The negro is the stone which the builders have always persistently rejected in the South. They might have made him the corner-stone of a sure political supremacy. They can now make him the foundation of social supremacy and advancement. Will they? The South at this moment has all the material elements of future and near impending empire in greater abundance and wealth than any section of this land or any other. She has raw materials, fertile soils, untold ores and mines, coals, vast undeveloped regions, ready means of transportation, and labor. Can she fuse them? The flux is brains."

It looks to us as if this question of labor in the iron working industries in certain parts of this country finds its solution in the way here indicated. It is no

new and untried experiment, the employing of negro labor in iron manufacturing establishments in this country. Before the war negroes found steady and profitable employment in rolling mills in the South, and the writer had occasion frequently during the war to observe the fact that negroes were almost exclusively employed in such establishments in Richmond and Atlanta, and also in some works on the Etowah River, in Georgia. We have knowledge of some extensive coal mining operations now being carried on in Ohio, the entire force of laborers being negroes, many of whom have acquired homes and worldly goods there as the result of their work—many of them having money to their credit in bank. Some technical education would be necessary of course to fit these people for such duties; but if such a class of labor as is now used, or has been used up to the late strike, becomes unavailable, it would be worth while for manufacturers to turn their faces to the South and at least make the effort to utilize the negro as a worker in iron. The experiment should be tried.—*Age of Steel.*

CHEMISTRY.

WATER GAS.

BY A. P. H.

When steam is brought in contact with incandescent coal or coke, it is deprived of its oxygen, which unites with the carbon, forming carbonic oxide, and the hydrogen is liberated. If the mixture of these two gases is brought in contact with the vapor of naphtha it acquires illuminating properties, and is the illuminating gas which is now manufactured on such an extensive scale in New York and many other large cities.

The first successful attempt to manufacture this gas was made by Michael Donovan, who obtained a patent for his process in 1830. Soon after, Jobard, a Belgian, obtained a patent. Then followed Selligue, Lowe, and others.

The process in most general use now is named after its inventor, Tessie du Motay, and is the one employed by the Municipal and New York gaslight companies in New York City. The operation is conducted as follows:—

The gasogens in which the water gas is generated are arranged in pairs along the main pipe, which passes through the center of the building. These gasogens consist of vertical furnaces, constructed of iron and lined with fire brick, and have a capacity of about ten tons of coal. In the lower portion on each side is a row of doors for the removal of cinders; on the top are two large openings for the introduction of coal, and a standpipe, which not only extends over to the main pipe, but has a vertical extension, the end of which can be opened or closed by means of a lid.

Through the center of the furnace is a fire-clay partition, which extends nearly to the top, and in this a coil of iron pipe. In working, a quantity of wood and coal is introduced into the gasogens: the doors are luted and the coal openings on the top closed, but the upper end of the standpipe is allowed to remain open to serve as a chimney. The blast is turned on till the wood is all burnt up, and judging from the color of the flame issuing from the standpipe the mass of coal has become incandescent. The blast is then shut off, steam is let in, and the lid of the standpipe is closed. The steam, which is generated in immense boilers at a high pressure, enters the coil of pipe contained in the fire-clay partition, where it is superheated, and then enters the mass of incandescent coal through a row of openings just above the grate bars. When the steam comes in contact with red-hot coal, the following chemical reaction takes place: $H_2O+C=CO+H_2$. Besides the carbonic oxide and hydrogen, some CH_4, CO_2 and H_2S are formed, and possibly other gases resulting from any impurities which may be contained in the coal. The pressure caused by the generation of these gases force them up the standpipe and over through a water seal into the main pipe; from here the gas enters a small holder, which acts as a governor, causing a steady flow of gas into the carburetters. The carburetters, which are situated at some distance from the gasogens, consist of ten or a dozen shallow trays, arranged one above another and surrounded by a steam jacket. A slow stream of naphtha, about five gallons to the 1000 cubic feet of gas, is allowed to run into the top one; when this gets full it overflows through a small pipe into the next lower, and so on. The heat of the steam in the jacket keeps the naphtha evaporating, and the vapors are taken up by the gas, which enters at the bottom, and after passing back and forth over the trays goes out at the top, and from thence to the retorts. These are about twenty feet long, of the same shape and arranged in the same manner as those used in the manufacture of coal gas; and they have perforated partitions across them in order to retard the flow of gas. These retorts are kept at a red heat. The gas enters at one end through pipes provided with valves for regulating the quantity, and passes out through a standpipe at the other end. The object of passing the gas through these retorts is to "fix" the naphtha vapor so that any lowering of the temperature will not cause a condensation of the illuminating constituents. In order to determine how well this is being accomplished the following simple test is used, which was patented in 1877 by Mr. H. C. Bowen:

A slip of white paper is held in front of a small stopcock attached to the standpipe; on opening the stopcock a small stream of gas strikes the paper, causing a stain, from the color of which the workman is enabled to decide whether the temperature of the retort is right. A brown stain is desired; if it is too dark it indicates that the temperature is too high, and more gas is let in; while if it is too light in color the reverse is the case, and some of the gas is turned off.

From the retorts the gas goes to the exhauster, which forces it through the condensers, scrubbers, purifiers, meters, etc., into the holders, where it is stored

till distributed. The process of condensing, purifying, etc., is essentially the same as that employed for coal gas, the impurities being about the same, with the exception of ammonia, which is seldom found in water gas.

Water gas as it comes from the gasogens, and before it is enriched with naphtha vapor, has a specific gravity about one-half that of atmospheric air, with quite a strong odor, and it burns with a non-luminous flame, producing an intense heat. It consists of about equal parts of carbonic oxide and hydrogen, some marsh gas, carbonic acid, and various other impurities from the coal.

After being enriched and purified it has still a strong odor, and has a specific gravity of about 0.66 compared with air. Its illuminating power differs with the amount of naphtha used, generally ranging from twenty-five to thirty candles. It is more combustible than coal gas, requiring less oxygen to burn it, and therefore should not have as deleterious an effect upon the atmosphere of a room in which it is burned.

When a mixture of water gas and air is exploded, the explosion seems to take place more slowly than in the case of coal gas and air, exerting a steadier pressure with less shock, as is shown by windows being blown out without breaking the glass.

The following is an analysis made by Mr. E. G. Love, city gas tester of the gas furnished by the Municipal company of New York City:—

Hydrogen	26.25
Marsh Gas	28.91
Carbonic Oxide	27.12
Illuminants	15.80
Nitrogen	1 92
	100.00

It is very generally known that water gas can be made more cheaply than coal gas, although both sell for the same price, because their luminous powers are about the same. When electricity shall displace gas for illumination, there will still be a field for water gas as fuel. As the enriching process can be omitted, the price can be reduced so that it will be as cheap as coal.—*Boston Journal of Chemistry.*

CHEMICAL PARADOXES.

We are accustomed to associate the idea of combustibility with paper. If it be wrapped tightly around a metallic rod it can be held in a gas flame without burning. The metal carries the heat away from it as fast as applied, becoming hot itself. After a while it will reach a temperature, provided the flame is large enough, at which the paper will burn.

This same phenomenon can be more strikingly exhibited by making a vessel of paper, filling it with water, and applying heat. No matter how hot the flame

over which it is placed may be, it will not burn. The water will boil, and the heat be absorbed, or rendered latent, in the production of steam. An egg can thus be boiled in a paper saucepan—quite in the Easter vein if we were a little earlier in the season.

A sieve may be made to hold water or to float. If the interstices are very fine and the wire bright and dry, the water will not wet it, because a film of air will adhere to the wires. The lower surface of the water is divided by the meshes into a number of little spheroidal projections, in which the capillary force or internal gravitation and also cohesion come into play. These hold the water together so that some considerable power is required to force the water through the meshes. Thus we can put quite a quantity of water in a fine sieve, or place one in water and it will float. If the wires are not perfectly bright we may distribute over their surface some powder which water will not wet. The dust of bituminous coal is excellent. Carrying out this principle, needles, if bright may be made to float without the least trouble, and will float for a long time.

Water is to be made to boil by cold. A flask half full of water is maintained at ebullition for some minutes It is removed from the source of heat, corked, inverted, and placed in one of the rings of a retort stand. If cold water is poured on the upturned bottom of the flask the fluid will start into violent ebullition. The upper portion of the flask is filled with steam which maintains a certain pressure on the water. By cooling the upper portion of the flask some of this is condensed, and the pressure reduced. The temperature at which water boils varies with the pressure. When it is reduced water boils at a lower heat. By pouring the cold water over the flask we condense the steam so that the water is hot enough to boil at the reduced pressure. To assert that water boils by the application of cold is a chemical sophism.

It seems paradoxical to see a genuine metal melt in boiling water. It is a general rule that alloys melt at a lower temperature than any of their components. By making an alloy of cadmium, bismuth, lead, and tin, in proper proportions, we form a compound that will melt far below the boiling point of water, or about 160° F. Yet the melting point of tin, the most fusible of the four, is over 450° F. A good way to exhibit this is to make teaspoons or punch ladles of it so that they will melt in the hot fluid. It would be an illustration of the old proverb, "There is many a slip 'twixt the cup and the lip."

Double decompositions are responsible for many of our titular experiments. By mixing solutions of ferric oxide and potassic ferrocyanide we obtain Prussian blue. The solutions may be so diluted as to be colorless. So two colorless solutions produce a colored one, the suspended precipitate coloring the mixture. So may chrome yellow, or lead chromate, and mercuric iodide, and, hundreds of other reactions be made to repeat this phenomenon. The acid radicals in these cases change places with each other. By proper succession very pretty effects may be produced. Thus five colorless solutions may be made to produce a colorless, a red, a colorless, a white, and a black mixture, all that is necessary being

to pour from the first vessel into the next, the second into the third, and so on. Numberless other combinations can be made.

To make two colored solutions produce a colorless one we may avail ourselves of the power possessed by nitric acid of bleaching indigo. Two solutions of indigo are made; one contains a good quantity of sulphuric and hydrochloric acids, the other contains potassic or sodic nitrate. On pouring them together and warming a colorless solution results, as the sulphuric acid sets free nitric acide and chlorine, which destroys the indigo.

Two liquids are to produce a solid. This is another double decomposition. Saturated solutions of calcic chloride and potassic carbonate are poured together, when a very heavy precipitate of calcic carbonate or chalk is thrown down. At the present time this seems rather a weak affair, but in its day it was called a chemical miracle. It is for this reason that I show it to you. It is historic.

Two gasses may produce a solid. This is effected by a simple combination. Ammoniacal gas and hydrochloric acid gas are both absolutely gaseous at ordinary temperature and pressure. If brought together they combine, forming a white solid substance called ammonic chloride or sal ammoniac. It is the substance used by tinsmiths to brighten the faces of their soldering bolts before tinning them.

If we immerse the bulbs of two thermometers, one in quicklime and the other in ammonic nitrate, and add water to each, contrary effects are produced. The quicklime has a strong affinity for water, and combines with it eagerly with evolution of much heat. The nitrate of ammonia, on the other hand, without much affinity for water, is very soluble, so it dissolves quickly, and in its passage from the solid to the liquid state renders latent or absorbs a great quantity of heat, causing a fall in the temperature, if rightly managed, of forty degrees. It is a very instructive experiment. To make it really impressive the water should be added from the same flask, so that there can be no fear that water of different temperatures is made to effect the result.

We now come to some phenomena of combustion. As we generally see it, it takes place in the air, which supplies the oxygen. But we can substitute for the oxygen of the air that of a highly oxidized salt such as potassic chlorate. If we mix this with sulphur, which is very combustible, and rub the two in a mortar we get a series of quite violent detonations. By the use of phosphorus instead of sulphur we have a still more violent explosive, which has to be handled with more care. The products of these reactions are primarily sulphurous and sulphuric and phosphoric oxides.

If we mix the same chlorate of potash with a proper proportion of sugar we have a mixture that the touch of a match will ignite and burn with great splendor. The carbon of the sugar unites with the oxygen of the salt. But it is quite unnecessary to use fire to start it. A drop of oil of vitrol or sulphuric acid will start the reaction, so that the deflagration will take place by decomposing the chlorate. Thus we have a solid set on fire by contact with a liquid.

We have already used phosphorus in an experiment which showed its great affinity for oxygen. By boiling it with a strong solution of potassic hydrate a mixed phosphureted hydrogen is set free which is spontaneously combustible. In practice it is made to bubble through water, and each bubble as it bursts produces a flash and spontaneous combustion. In oxygen the explosion is very violent. This gas has a special interest, as the *ignis fatuus* has been explained by it—whether truthfully or not is not certain. It is one of the most beautiful exhibitions of spontaneous combustion in all chemistry. It is susceptible of many modifications.

As a finale I propose to exhibit to you fire under water. We select as two suitable substances phophorus and chlorate of potash. These are placed in the bottom of a flask and water poured over them. To start and maintain the combustion we add sulphuric acid. A highly oxidizing compound is formed, and the phosphorus begins oxidizing or burning with a bright light. To make it more beautiful we can add phosphide of calcium, when, in addition to the white glow of the phosphorus, we have an elegant emerald green glow added to our fire under water. It is not a safe experiment by any means, as there is danger of breaking the vessel by the violent heat caused by the reaction.—*Scientific American.*

PREVENTION OF SMOKE.

At a meeting of the Society of Engineers, held on Monday evening, June 13th, a paper was read by Mr. A. C. Engert on the "Prevention of Smoke."

The author, in choosing the title of the "Prevention of Smoke," instead of the "Consumption of Smoke," gives it as his opinion that smoke, once produced by the atmosphere and while being carried by the air, cannot be consumed, as every particle is surrounded by a thin film of carbonic acid. When, however, smoke is condensed as soot, heat will liberate the carbon from the acid, and then the former will burn rapidly. If this theory is found to be correct, carbon cannot destroy the germs of disease floating in the air.

For the consumption of smoke, many ingenious and elaborate inventions are on record, but not yet adopted on account of expense and complexity of mechanisms. A simpler apparatus is, therefore, required.

To prevent smoke, the cold air must not be allowed to come in contact with the gases arising from green coals, and, for this purpose, the furnace is, so to speak, divided into two parts. The fire-door is removed from the boiler, and a box fixed on in front. On each side of this box rails are placed inside, on which a plate or shutter may rest, which can be pushed forward or backward as required. When pushed forward it passes within the boiler and drops over the fire bars some eighteen inches, thereby cutting off the draft and preventing the condensation of the gases arising when fresh coals are put on, thus preventing smoke and the cooling of the boiler.

A still more simple apparatus can be made with the same results, if the opening or flue will admit a higher box. The shutters can be cast together in one piece at an angle of about 130°, to hang within the box on two pins or bolts, thus forming a swinging shutter. A rack is attached to the front of the shutter to regulate the movement.

The advantages of this apparatus are—the cooling of the boiler is entirely avoided, the gases are consumed so that smoke is prevented, and there is a saving of from 15 to 20 per cent of heat and coal.

In ordinary open fire grates the same object is attained—viz.: the prevention of the cold air from coming into contact with the green coal, by removing the fire lump, and substituting for it a cast-iron box, which stands out on the back and is open in front only, and which is filled with coal. Within this box is a movable iron plate, which can be forced forward, carrying with it the coals from which the gases have been extracted and consumed by the heat in front, or moved backwards when the box wants refilling. To regulate the draught so that the fire burns brightly in front, a plate is fixed under the grate, coming forward at the bottom. Another plate, resting on pins, is placed on the top of the box to prevent the flame entering the register.

By this simple apparatus a bright fire is maintained in front of the grate, half of the heat usually escaping into the chimney is saved, there is little or no smoke, and the smallest coal can be used, and is, indeed, preferable.

In kitcheners, stoves, and vertical boilers, a similar box to foregoing can be fixed, the movable plate being worked by a lever.

This invention is also of great importance to railway companies, as it can easily be applied to locomotives. A box is placed under the foot-plate, the whole width of the fire grate, and the coals put in from the top. By this means the gases are almost entirely drawn out of the coal and consumed, the result being very little, if any, smoke. To supply the grate, the coal is pushed forward by a movable plate and lever.

Whether applied to furnaces, ordinary open fire-grates, stoves, kitcheners, vertical boilers, or locomotives, the results of this invention, in each case, are a great saving of heat and fuel, and the reduction of smoke to a minimum.—*Van Nostrand's Engineering Magazine.*

CORRESPONDENCE.

SCIENCE LETTER FROM PARIS.

PARIS, August 13, 1881.

M. Gautier, a distinguished chemist, has discovered that our saliva is toxical and contains a venom identical with that in the saliva of the boa and the viper, the only difference being that of the concentration. In the human saliva, the poisonous substance discovered is neither a virus nor a ferment, but a venom, and its activity cedes in nothing to the most powerful vegetable poisons. M. Pasteur in March, last, on inocculating rabbits with the saliva of sick children, found the animals had contracted a special disease and died. Here the infection was virulent, produced by a virus or special animalcule. The human saliva, in point of toxical intensity, differs, as in the case of serpents. When man is in a passion, the saliva is more poisonous. Deaths are on record produced by the bites of man and animals when in a state of anger. Professor Gautier took three-quarters of an ounce of human saliva, after three hours evaporation in a *bain marie*, the residue was mixed with tepid water and injected under the skin of a bird; the bird became instantly attacked with intense stupor, could not remain standing; in fifty minutes it fell, bill forward, on the ground, and remained in that position during four hours, when it either died or returned slowly to life. The Professor has not been able to isolate the alkaloid in the human saliva, but it acts similarly as the most terrible vegetable alkaloid. But how can we live, swallowing as we do this fearful poison, for the saliva is an essential agent in the digestion of our food—farinaceous substances especially? The venom is equally innocuous with serpents. Some animals, the hedgehog and the pig for example, can eat poisonous serpents with impunity; and it has been shown that the venom itself and the venom glands, can be swallowed in cases without danger. There is no clear explanation for these facts, but it is believed their virulency is neutralized by the matter secreted by the bile—acting as a counter-poison. But while we can swallow with impunity our saliva, it would be imprudent to inject it under our skins in large quantities. M. Gautier also has discovered the presence of venomous matters in the normal products of the secretions. It thus seems, that all animals fabricate poisons. Dr. Corre, has this year drawn attention to venomous fishes; certain fish in the tropical seas cannot be eaten without producing poisonings. Physiologists have devoted much attention of late to the toxical principles found in bodies in a state of putrefaction; they are alkaloids of extreme virulence following M. Selmi, and may be either fixed or volatile; they are chiefly to be found in the visceræ. How important becomes this subject, if the medico-legal expert cannot distinguish between these self-produced poisons and an alkaloid administered by a criminal hand. The late case of an Italian general is too sig-

nificant. Some experts concluded he was poisoned, while the toxical principles had been ordinarily fabricated by the putrefaction of his remains. Animals then like vegetables, can manufacture poisons.

A distinction must be kept in view between toxical virus, the product of decomposition, and the venom of saliva and serpents. A low temperature will destroy virus, but a trace of virus will, if introduced into the organism, spread with a fearful rapidity. Venom can be submitted to a temperature of 280°, during three hours, and never lose its toxical properties. Besides venoms act in proportion to their weight. Virus is animated, can reproduce and develop itself. Venom is a chemical compound or a poison acting chemically. In poisoning by venom, the muscles never contract under the influence of an electric current. Venom can be boiled, filtered, treated in alcohol, and still retain its toxical quality; its active principle must then be an alkaloid, not a ferment. Professor Gautier has discovered an infallible specific against venom; not tannin, or turpentine or ammonia, but a solution of caustic, potash or soda; hence, the necessity when traveling to have a preparation of either in the pocket medicine-case. When bitten by a serpent, tie instantly the part tightly above the wound, to arrest the circulation of the blood, for in less than half a minute the poison can be conveyed through the whole system; inject the bite next with the solution of potash. Other practical lesson, avoid allowing dogs to lick your hands. In the case of stings of insects, ammonia is efficacious, and if the neck of the bottle be placed over the wound, inflammation will be kept down; the active principle in the venom of a wasp, etc., is acid, and hence, can be dissolved by ammonia. In the venom of serpents, etc., its principle does not dissolve in ammonia, but it is neutralized by caustic, potash and soda.

There are no indications that the mania for undercooked beefsteaks is on the decline; in restaurants, only such are served. This refers to robust people, but weakly persons continue to patronize pounded raw chops and steaks, and the juice of uncooked meat. M. Toussaint exposes the grave dangers of patronizing such a dietary, as, if the meat be unsound, the germs of disease will inevitably pass into the system. He states no contagious malady possesses greater virulence than tubercular affections, or consumption, and that is the form of the disease most to be encountered in meat sent to the market. In the slaughter-houses, an ox, etc., is not rejected as unfit for food, unless the lung be entirely affected, but grey granulations may still exist and produce infection. M. Toussaint took the lung of a cow not at all much affected with consumption; he placed it under a press and collected the juice; he inoculated rabbits and young pigs with the liquid as it came from the press, and after he had heated another portion to 114° F., the result was, all the subjects died within a very short period. He extracted the juice in the same manner from the thigh of a pig, dead from consumption, previously cooking the flesh, to correspond with that served in hotels, etc., according to the latest fashion. Then he inoculated rabbits with such grilled juice, and they also invariably died of consumption. There are cases where the consump-

tion of raw meat is necessary; here duty suggests to ascertain well the origin of such meat; in all other cases it is prudent to only eat meats suitably cooked, that is, meat whose interior has been acted upon by a temperature of 150° or 160°.

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A still more simple apparatus can be made with the same results, if the opening or flue will admit a higher box. The shutters can be cast together in one piece at an angle of about 130°, to hang within the box on two pins or bolts, thus forming a swinging shutter. A rack is attached to the front of the shutter to regulate the movement.

The advantages of this apparatus are—the cooling of the boiler is entirely avoided, the gases are consumed so that smoke is prevented, and there is a saving of from 15 to 20 per cent of heat and coal.

In ordinary open fire grates the same object is attained—viz.: the prevention of the cold air from coming into contact with the green coal, by removing the fire-lump, and substituting for it a cast-iron box, which stands out on the back and is open in front only, and which is filled with coal. Within this box is a movable iron plate, which can be forced forward, carrying with it the coals from which the gases have been extracted and consumed by the heat in front, or moved backwards when the box wants refilling. To regulate the draught so that the fire burns brigl tly in front, a plate is fixed under the grate, coming forward at the bottom. Another plate, resting on pins, is placed on the top of the box to prevent the flame entering the register.

By this simple apparatus a bright fire is maintained in front of the grate, half of the heat usually escaping into the chimney is saved, there is little or no smoke, and the smallest coal can be used, and is, indeed, preferable.

In kitcheners, stoves, and vertical boilers, a similar box to foregoing can be fixed, the movable plate being worked by a lever.

This invention is also of great importance to railway companies, as it can easily be applied to locomotives. A box is placed under the foot-plate, the whole width of the fire grate, and the coals put in from the top. By this means the gases are almost entirely drawn out of the coal and consumed, the result being very little, if any, smoke. To supply the grate, the coal is pushed forward by a movable plate and lever.

Whether applied to furnaces, ordinary open fire-grates, stoves, kitcheners, vertical boilers, or locomotives, the results of this invention, in each case, are a great saving of heat and fuel, and the reduction of smoke to a minimum.—*Van Nostrand's Engineering Magazine.*

CORRESPONDENCE.

SCIENCE LETTER FROM PARIS.

PARIS, August 13, 1881.

M. Gautier, a distinguished chemist, has discovered that our saliva is toxical and contains a venom identical with that in the saliva of the boa and the viper, the only difference being that of the concentration. In the human saliva, the poisonous substance discovered is neither a virus nor a ferment, but a venom, and its activity cedes in nothing to the most powerful vegetable poisons. M. Pasteur in March, last, on inoculating rabbits with the saliva of sick children, found the animals had contracted a special disease and died. Here the infection was virulent, produced by a virus or special animalcule. The human saliva, in point of toxical intensity, differs, as in the case of serpents. When man is in a passion, the saliva is more poisonous. Deaths are on record produced by the bites of man and animals when in a state of anger. Professor Gautier took three-quarters of an ounce of human saliva, after three hours evaporation in a *bain marie*, the residue was mixed with tepid water and injected under the skin of a bird; the bird became instantly attacked with intense stupor, could not remain standing; in fifty minutes it fell, bill forward, on the ground, and remained in that position during four hours, when it either died or returned slowly to life. The Professor has not been able to isolate the alkaloid in the human saliva, but it acts similarly as the most terrible vegetable alkaloid. But how can we live, swallowing as we do this fearful poison, for the saliva is an essential agent in the digestion of our food—farinaceous substances especially? The venom is equally innocuous with serpents. Some animals, the hedgehog and the pig for example, can eat poisonous serpents with impunity; and it has been shown that the venom itself and the venom-glands, can be swallowed in cases without danger. There is no clear explanation for these facts, but it is believed their virulency is neutralized by the matter secreted by the bile—acting as a counter-poison. But while we can swallow with impunity our saliva, it would be imprudent to inject it under our skins in large quantities. M. Gautier also has discovered the presence of venomous matters in the normal products of the secretions. It thus seems, that all animals fabricate poisons. Dr. Corre, has this year drawn attention to venomous fishes; certain fish in the tropical seas cannot be eaten without producing poisonings. Physiologists have devoted much attention of late to the toxical principles found in bodies in a state of putrefaction; they are alkaloids of extreme virulence following M. Selmi, and may be either fixed or volatile; they are chiefly to be found in the visceræ. How important becomes this subject, if the medico-legal expert cannot distinguish between these self-produced poisons and an alkaloid administered by a criminal hand. The late case of an Italian general is too sig-

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nificant. Some experts concluded he was poisoned, while the toxical principles had been ordinarily fabricated by the putrefaction of his remains. Animals then like vegetables, can manufacture poisons.

A distinction must be kept in view between toxical virus, the product of decomposition, and the venom of saliva and serpents. A low temperature will destroy virus, but a trace of virus will, if introduced into the organism, spread with a fearful rapidity. Venom can be submitted to a temperature of 280°, during three hours, and never lose its toxical properties. Besides venoms act in proportion to their weight. Virus is animated, can reproduce and develop itself. Venom is a chemical compound or a poison acting chemically. In poisoning by venom, the muscles never contract under the influence of an electric current. Venom can be boiled, filtered, treated in alcohol, and still retain its toxical quality; its active principle must then be an alkaloid, not a ferment. Professor Gautier has discovered an infallible specific against venom; not tannin, or turpentine or ammonia, but a solution of caustic, potash or soda; hence, the necessity when traveling to have a preparation of either in the pocket medicine-case. When bitten by a serpent, tie instantly the part tightly above the wound, to arrest the circulation of the blood, for in less than half a minute the poison can be conveyed through the whole system; inject the bite next with the solution of potash. Other practical lesson, avoid allowing dogs to lick your hands. In the case of stings of insects, ammonia is efficacious, and if the neck of the bottle be placed over the wound, inflammation will be kept down; the active principle in the venom of a wasp, etc., is acid, and hence, can be dissolved by ammonia. In the venom of serpents, etc., its principle does not dissolve in ammonia, but it is neutralized by caustic, potash and soda.

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deaths is greater. At the commencement of the century the average age for the population to arrive at was thirty-one and a half years, the figures now are thirty-six years, and this the Doctor attributes to improved sanitary causes and a more scientific knowledge of medicine. However, as there are less births in the country, the infant death rate must be less, and that is very important in striking a general average. Dr. Bertillon has drawn attention to this curious fact, that where property is very divided, the mortality also is less; on the contrary where property is less divided, there are more deaths, and also more births. In Normandy this is not quite exact; in rich Normandy, where proverbially marriages are so largely childless.

METEOROLOGY.

THE WEATHER-PROPHET FARCE.

BY ISAAC P. NOYES, WASHINGTON, D. C.

Probably nothing illustrates the general ignorance of meteorology more than the faith of the intelligent classes in the great farce of attempting to forecast the weather upon the principle that the weather periodically repeats itself.

When men are carried away by ignorance, it is astonishing how blind they will be to all the facts which oppose their belief and how ready they are to parade before the eyes of the world a few scattering facts which *seem* to substantiate their theory of belief; whereas, if they were more familiar with the branch of science they would have us join them in, these very scattering and isolated facts would be proof to them of ignorance on the part of anyone attempting such a thing; and more especially would they condemn it on the part of one holding a high position in life, a position which could not be held by an ignorant person; that is, ignorant persons are to be excused where blame would and should rest upon them if they had had the advantages of education, while for the intelligent person there is no such excuse or charity. Intelligence seeks to enlighten—it does not attempt to thrive upon ignorance; and if the intelligent person is so blinded by some pet idea that he continues to follow the paths of darkness rather than light, so much the worse for him, and the more is he, according to circumstances, to be pitied or condemned.

To speak of prophesying the weather after this manner as a *farce* may displease many good people, yet I simply ask them to put away all bias and look at the question from both sides—not to continue to do as they do at present, say nothing of the many failures of this process, and when something favorable occasionally occurs parade *that* before the eyes of the world as evidence of great wisdom and complete knowledge of the whole subject. For example, suppose

great knowledge of geography was claimed for some person, and he even claimed for himself that he was in this branch of knowledge superior to the rest of the world, and he was asked some ten or a dozen questions as to the location of places, etc., and he should answer only two or three correctly and then the public should shut their ears to his mistakes but praise him generally, and give him great credit for the few right answers, and by their words imply that he knew it all and better than anyone else. Would it not seem absurd? Yes, it would, because we as a people understand geography pretty well, but when it comes to the weather even the intelligent world is surprisingly ignorant, and this ignorance shuts our eyes to a multitude of errors and makes us grasp a few points of seeming wisdom as the fullness of wisdom itself.

When a man willingly takes a stand before the world and lets it be understood, and even claims for himself, that his wisdom in a certain line is superior to the rest of mankind he must expect to have his work weighed in the balance, and if found wanting, to be condemned and rejected.

It is astonishing that so few people of intelligence have considered it worth their while to study the beautiful yet simple laws which go to make up our weather system.

Although it is claimed that the "Great Canadian Weather Prophet" is a wise man, he has not thus far given the world one new idea in regard to the weather; indeed, any knowledge of the laws of storms, any information as to the changes of the seasons, from heat to cold and cold to heat, would only tend to reveal the fact that the system based upon the idea of weather periodically repeating itself, and weather prophecies based thereon are of no value. But we often hear it said "He *hit* it this time." If any intelligent person will study the weather map every day, even for a month, and note the changes, following them up day after day they will, I think, see the great absurdity of the idea of "hitting it." Knowledge on a subject like this is not like firing at a mark.

The changes of the weather follow certain fixed laws and are the result of certain combinations of forces. These forces do not follow in fixed grooves. In this respect nature much resembles a kaleidoscope and is as endless in her varieties of storm and sunshine as in the varied forms of her clouds; and I am thinking that when we can carry our mathematics to such an extent that we can calculate the changes of form and color in the kaleidoscope *in advance* we can then hope to calculate with certainty the exact changes of nature in advance; until then we must be satisfied to take the weather as we find it revealed on the daily map. As often explained in these papers we can with considerable certainty forecast the weather from three to four days in advance, *i. e.* from one change to another (from one "Low" to another). We cannot do any more and we cannot always do this. The length of time ahead depends upon the changes made by nature.

During midsummer it is more difficult to say when there will be a storm than during the spring months, for the reason that the storm-centers, or "Low" so continually travel on such a high line of latitude, and there is often so *little*

moisture in it—being dissipated by heat—that it is very uncertain when and where it will precipitate, while during the spring months the storms traveling on a lower line, and passing on an average of about a four days' period it is much easier to predict rain and to make a schedule of time for storms which, to the ignorant, may seem very wonderful. But after all even during the spring months there is no more certainty that a storm-center will follow in the exact line of the one that preceded it than during mid-summer. The line of the storm-centers of this year are not like those of last year or of any preceding year. It is simply impossible for any great degree of similarity in this respect.

Probably nothing tells so much for or against a person as their own words, and every person who puts his thoughts upon the printed page should be willing to abide by them. If he is in the right fair quotations therefrom cannot hurt him, while if he be in error, there can be no stronger proof brought to bear against him.

In his almanac Mr. Vennor says that "July bids fair to be excessively hot and tempestuous, the hottest days probably being the 4th, 5th 9th, 11th, 16th, 17th, and the 25th and 26th. Thunder and lightning storms are likely to occur in many localities, on the 1st, 5th, 8th, 9th, 15th, 17th or 18th, 27th or 29th. Should frosts occur during the month the 13th, 21st, 23d and 31st are likely dates for such. The month will probably terminate with cool evenings and nights."

In this statement localities are not mentioned; no reasonable localities, say western, middle or eastern sections of the United States and Canada, and yet one who knows anything about the weather system of the globe, well knows that all of the above weather might happen in one section and not in another; for example from the 17th to 18th of August it was reported very hot in the northwest, yet it was not hot in the eastern portions of the country, indeed it was the while getting cool and on the 19th it was quite cool for summer weather. The reason for this was that the new "low" of the 16th started in the northwest, making it hot there, but this "low" did not, for some reason unknown to us, continue on a high line, but as it advanced eastward took a southeast course making it quite cool in the northeast. It passed the locality of Washington without any precipitation, and then followed the line of the coast in a northerly direction—on the 20th centering off the coast of New England and again making the eastern portion of the United States very warm.

Not satisfied with the statement in his almanac, during the latter part of June Mr. Vennor issues *another* statement, wherein we were to have heavy rains from the 20th to the 22nd of July in New York and vicinity. Between the 10th and 15th an exceedingly hot term. Well it was hot generally throughout the country on these days, but it was also as hot almost from the very first of July and right along until the 18th, when for reasons most beautifully revealed on the weather map it was a little cooler. But Mr. Vennor made no mention of this in *any of his statements for July*. He did say, however, "within a few days from the close of the month, probably about the 27th or 28th, a cool wave will occur." Because we had the cooler weather about the 18th, it was a common thing to hear ignor-

ant people claiming it for Mr. Vennor. When confronted with the "weather prophet's" own statements the few fair-minded ones admitted that it was not "just so" and that he was a little "off" this time. Again, on the 21st of July, Mr. Vennor appears with a supplement for the last half of the month, wherein the 24th was to be hot and windy; 25th oppressive and stormy; 26th and 28th cloudy, cool weather, with cool nights and cool showers; 29th cool and showery; 30th and 31st warm weather, high winds and rain showers."

The 24th was not hot and windy, the 25th was warm but not "oppressive and stormy." We did not have a heavy rain storm and winds on the 26th. The rest of the month was very even, neither hot nor cold. On the 30th the barometer was highest in the northeast with an extended area of "high" generally over the United States while an area of "low barometer" was appearing in the northwest.

So much for July. For August no better success attended these efforts, at least up to the time of writing this article. In his almanac for August Mr. Vennor says, "August, in striking contrast to the same month in 1880, looks decidedly moist, and will probably resemble that of 1877 in Canada and the United States. The month will enter warm, but cooler, and rather unseasonable weather may occur on the 4th and 5th, after which sultry and stormy weather will again set in. Thunder and lightning and hail storms are likely to cause considerable damage over wide spread areas both in Canada and the United States, especially in western sections, and the month again promises to resemble that of the year 1877."

His after statement in the daily papers is as follows: "1st, probably warm and oppressive; 2nd—5th generally pleasant weather with fairly warm days and cool to cold days, and fall-like evenings and nights; 6th fair and pleasant; 7th Sunday, heat and storms; 8th and 9th sultry weather with heavy showers, cooler evenings and nights; 10th ditto; 11th—13th heat again in the United States, with cloudy and sultry weather, with storms in Canada; 14th Sunday, cooler—change; 15th cooler to cold and cloudy and pleasant; 16th storms in Virginia; 17th and 18th hail storms, and frosts probably in some sections; 19th heat and storms; 20th ditto; 21st Sunday, sultry and showery; 22nd sultry and windy; 23rd heat and wind; 24th ditto; 25th and 26th heavy storms on the lakes, St. Lawrence and New York; 28th and 29th cooler weather with rains and frosts in northern sections; 30th and 31st fair and pleasant with cool evenings and nights with indications of returning heat."

Up to the time of writing (August 22nd), this has certainly not been a wet month; on the contrary it has been a very dry month, and if one will take the trouble to refer to the weather map he or she will see not only what kind of weather we had here at the National Capitol, but what they had all over the country, and they will also see that any intelligent person with a knowledge of August weather in this country could have written out as good a probabilities as any weather prophet of this or any other country. The month began with "low" in the northwest, making it hot. On the 2nd there was a "low" in the Gulf,

but on account of a new "low" starting in the northwest it did not cool much, but continued hot, although the chances were that but for this southern "low" it would have been much hotter throughout the country. The southern "low" neutralized the heat of the northern one. So long as "low" was on a high line it continued hot up to the 7th. On the 6th a "low" appeared in the southwest but it was not of sufficient power to create any very great change. On the 7th the extended "low" in the northwest overpowered the influence of the one in the south. On the 7th however it was somewhat cooler. The southern "low" neutralized the heat created by those of the north, and those of the north neutralized the cold which would have been developed by those of the south had they been the only ones present in the country. 8th, 9th and 10th "low" traveled on a high line again, by the 10th making it quite hot, and this notwithstanding a "low" in the south. By the 11th the southern "low" had worked along the coast up as far as Cape Hatteras, neutralizing the influence of the northern "lows." But this "low" as it worked along the coast to the north took the heat of the south with it and added it to the heat already present in the north, the result of which was a very hot day on Saturday the 13th. Sunday the 14th it was still hot and pleasant, a "high" advancing from the west kept it a little cool and pleasant so the 15th of August was about as fine a summer day as one could wish to see, "high" being quite extensive over the northern portions of the United States.

On the 16th Mr. Vennor was to have "storms throughout portions of Virginia." But as we cannot have storms without a storm center, and as there was no storm center within a thousand miles of this locality there was no show for storms in Virginia, nor did they have any in that neighborhood until the 18th when the storm center advanced to that locality, passing it from the 19th to the 20th. Because of what Mr. Vennor said of the weather for the 14th—18th inclusive many of his friends are very ready to claim for him the cool weather in the east and north from the 17th—19th inclusive. Had the *other* conditions followed and the *whole thing* been complete with the *storms in Virginia on the 16th*, with "hail storms and frosts probably in some sections," on the 17th and 18th, then there might have been some reason in such a claim, but as it is it seems very absurd to make selections in such matters—indeed, it is too foolish and too much of a farce for intelligent people to heed. What must the people of the northwest think of this when it was very hot in their section from the 17th to the 18th. It was simply cool in the eastern sections of the country on account of the peculiar relations of "high" and "low." One glance at the weather map for these days explains it all. It is useless and profitless to follow up these daily records forever in order to prove that "John Smith" has not proved a good prophet. Already sufficient facts have been cited to show the absurdity of the attempts at forecasting the weather on the basis of the weather periodically repeating itself. That some "prophet" may "hit it" sometimes is no wonder at all—others can do as well—and one intelligent person may know as much about it as another.

In these papers criticism has been a secondary feature. Mere criticism is of very little account. Unless a man can do more than that he had better not say anything. In all of these papers the attempt has been to instruct, to throw light upon a subject of great interest, which from peculiar circumstances—want of general facts—long remained in darkness. Criticism of the "weather prophet" system has only been introduced as auxillary to this instruction. In the past such a system, if it may be so honored, was excusable, but its days are past and any further continuation of this "system" is the merest farce, too simple for intelligent persons to regard with the least favor. It is not to be depended upon; is not reliable and is generally unworthy of the attention of intelligent people.

WASHINGTON, D. C., August 22, 1881.

PORTABLE METEOROLOGICAL STATION.

Under this name is designated an instrument especially adapted for the use of travelers in mountain excursions in order that they may be able to observe and accurately register the different atmospheric phenomena they experience, and so fill the gap that generally exists in the history of Alpine and other ascensions.

This instrument is so arranged that it can, in any place, conveniently and exactly determine the most important meteorological phenomena, the pressure and temperature of the air, and its degree of humidity. It is a combination of a barometer, thermometer, hygrometer, and compass, arranged in a small case that can easily be carried, as it weighs one kilogramme.

The different parts are so perfectly balanced that the instrument can be used in any position and can stand, without injury, the rough usage of mountain traveling.

The barometer is the aneroid, a well-known instrument, and is especially adapted to show the pressure of the atmosphere, and the elevation of the place of observation above the sea level.

The temperature is shown by a mercurial thermometer, fixed on a copper tube, that forms a general support for the whole apparatus. The thermometer registers the centigrade system from 25° below zero to 40° above.

The degree of humidity in the atmosphere is determined by a Saussure hair hygrometer, which is slightly modified in this apparatus. A well constructed hair hygrometer gives results sufficiently accurate for general meteorological observations, as the hairs work regularly, and their small bulk causes them to be easily affected by the surrounding air, which is a great advantage when there are only a few moments to make an observation.

This hygrometer is the only one available for those altitudes where the temperature is below zero, and where, consequently, neither the psychrometer nor the condensing hygrometer could be used.

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Another advantage is that it shows immediately the degree of humidity, for a table, inscribed on the semi-circumference of the circle, gives in a moment the equivalent of the degrees of the hygrometer in the fractions of saturation of the air.

By this method we can make most interesting comparisons of the humidity of the fogs and mists that are encountered on the mountains and in the vicinity of elevated lakes.

It is easy to see the utility of the compass, which shows the position of the country, and is especially useful to the traveler, when exploring an unknown place or surrounded by a heavy fog. The direction of the wind can also be easily ascertained by tying a piece of ribbon to the ring at the top of the instrument, and so making it still more useful —*La Nature.*

TREE CULTURE ON WASTE LAND.

Hitherto the abundance of natural timber in this country has made it easy to dispense with timber culture, and for the most part our land owners have taken little interest in such slow-growing crops. This state of things, however, is rapidly passing away. The demand for special woods for manufacturing purposes is steadily and rapidly increasing, while the natural supply is diminishing, and must ultimately become quite inadequate. Meantime there are millions of acres of land suitable for timber culture and for nothing else, except poor pasturage that our land owners are allowing to lie waste and idle for lack of a little forethought, and too frequently our would-be thrift farmers will risk their surplus means in wild-cat speculations, promising, but never yielding, large and speedy returns, when the same money, spent in planting timber, would soon convert their worthless swamps and stony places into valuable properties.

A correspondent of the *Scientific News*, writing from Wisconsin, tells of a piece of land that was planted with walnut twenty-three years ago. The land was flooded every spring and summer, and was unfit for ordinary cultivation. The trees are now from 16 to 20 inches through, and have been sold for $27,000. No particulars have been given as to the cost of planting the grove, or the amount of attention it has had during the years of growth. There can be little doubt, however, that the investment was small in comparison with the return, and the land would otherwise have remained entirely unproductive. To the country the timber crop was so much clear gain. It is clear that our national resources might be enormously increased by a similar utilization by timber culture of lands which are now left unused and unproductive; and the planters would find their groves a surer investment for the security of their family possessions than any savings bank deposit.

EXTENDING THE UTILITY OF THE SIGNAL SERVICE.

The suggestion has been made to extend the utility of our already very efficient Signal Service by adding to its scientific labors the work of making systematic observations respecting the electrical condition of the atmosphere. The proposal is that these observations shall be made, as meteorological observations are now made, simultaneously by a large number of competent observers over large areas, in order that the general laws respecting the connection of the electrical state of the atmosphere with meteorological conditions—which connection is known to exist, but is very imperfectly understood—may be worked out and formulated. It is known, for example, that the prevalence of certain winds along our coasts is usually accompanied by peculiar electrical states of the air; and the coming of these winds can be predicted, even in the present imperfect state of our knowledge, by observations on the electrical state of the air. With respect again to thunder-storms, it has long been known that their advent is almost invariably preceded by pronounced electrical disturbance, which could frequently, if not always, be recorded upon delicate electrical apparatus, with a clear sky and sunshine above.

The important practical bearing of these facts upon the meteorological work now being carried on so successfully by our Signal Service observers is too obvious to require explanation. The great progress in meteorology that has been made during the past decade, has been almost entirely due to the adoption of the plan of making systematic and simultaneous observations over very extended areas; and the little that we at present know of the relation subsisting between the electrical state of the atmosphere and meteorological phenomena, is sufficiently suggestive to justify the opinion that highly important scientific and practical results would follow the establishment of electrical observing stations in connection with those of the Signal Service.

The suggestion of extending the operations of the Signal Service by incorporating a system of electrical observations into the routine work of its numerous observers, has frequently been mooted by scientific men and discussed at scientific gatherings. While the great interest and almost certainty of valuable practical utility that would result from this extension of the work of the Signal Service has been universally admitted, no steps have as yet been taken on the part of the government to put the idea into practical shape. The proposed extension of the duties of the Signal Service would entail a large increase in the annual expenditure of the corps; and it is plausibly argued that the government would not be justified in incurring this yearly addition to its expenditures until the utility of the new scientific observations to commerce and agriculture shall have been demonstrated. In view of the very strong probability, in the light of our present imperfect acquaintance with this interesting subject that great benefits would result from the new departure, the argument just stated appears to be exceedingly weak; but happily a way has been found out of the difficulty which promises to

solve it and to place the difficulty which promises to solve it and to place the subject of electrical observations before the government authorities in such shape at an early date, as to command their attention and support. The plan in question is embraced in a recent proposal that a number of our leading scientific institutions shall cooperate with the Signal Service in putting this work into practical shape, and thus test its utility. The plan has, we believe, been very favorably considered, and we may hope to see it in practical operation at an early date.

Prof. John Trowbridge, of Harvard University, who has taken great interest in the subject, has written a very interesting account of the proposed plan of cooperation, from which we glean the following facts. He says:

"Since our knowledge of meteorological phenomena depends upon simultaneous observations extended over large areas, a number of stations for observing the electrical state of the air should be established in connection with the Signal Service. The practical difficulties, however, in establishing such stations are great. Each station would require an original outlay of not far from $1,000, and the salary of an observer must make part of the yearly expense of the station. This observer must be an experienced man, of a higher grade than the assistants in an ordinary meteorological station. In view of the large expense for equipping and maintaining such electrical stations, it is not probable that the Signal Service will establish them until it has been shown that the observations from such stations possess great importance to commerce and agriculture.

"By a simple plan of cooperation with the Signal Service, Harvard University, Yale, Columbia and Princeton Colleges, the University of Pennsylvania and the John Hopkins University could enable the United States Government to try the experiment of establishing electrical stations with the minimum of expense. The expense of erecting suitable buildings and of providing experienced observers, could be greatly diminished if each institution would furnish observers and suitable rooms. These institutions form a cordon of nearly a thousand miles along the Atlantic coast where commerce is most active. It is probable that they would be relieved of the routine work necessary for simultaneous observations on the electrical state of the air, when it had been shown that such observations are valuable from a commercial point of view: for as soon as the universities have performed their high function of leading in scientific inquiry, and the results affect the daily pursuits of mankind, new observations in meteorology, which require special scientific inquiry in physical laboratories, should lead the Signal Service to again extend its observations."—*The Manufacturer and Builder.*

ASTRONOMY.

ASTRONOMICAL NOTES FOR OCTOBER, 1881.

BY W. W. ALEXANDER, KANSAS CITY, MO.

THE SUN.

Date.	Right Ascension.	Declination S.	Diameter.
1st.	12h. 31m. 46s.	3° 25′	32′ 03.3 ″
15th.	13 23 11	8 45	32 11.02
31th.	14 24 15	14 19	32 19.48

Sidereal time of mean noon on the 1st 12h. 42m. 27.49s; on the 31st 14h. 40m. 44 09s. Equation of time for apparent noon, 1st 10m. 30s; 31st 16m. 18s Equation of time is used to avoid the irregularity which would arise from using the true sun as the measure of time, a fictitious sun, called a *Mean Sun*, is supposed to move in the equator with a uniform velocity. This mean sun is supposed to keep, on the average, as near the real sun as is consistent with perfect uniformity of motion; it is sometimes in advance of it, and sometimes behind it, the greatest deviation being 16m. 18s.

THE MOON.

Date.	Right Ascension.	Declination S.	Semi-diameter.
1st.	19h. 28m.	18° 37′	16′ 13″
5th.	23 11	00 16 N.	16 22
10th.	3 46	20 55	15 30
15th.	8 07	16 09	14 48
20th.	11 55	4 44 S.	15 09
25th.	16 17	21 38	15 51
31st.	22 01	6 36	16 11

The most favorable time for making telescopic observations will be from the 12th to the 16th and from the 27th to the end of the month. It reaches perigee on the 4th, apogee on the 16th and returns to perigee on the 31st.

MERCURY.

Date.	Right Ascension.	Declination S.	M. T. of Meridian Passage.
1st.	13h. 49m.	12° 47′	1h. 07m. P. M.
5th.	14 09	15 05	1 11
10th.	14 33	17 36	1 15
15th.	14 54	19 40	1 17
20th.	15 12	21 06	1 15
25th.	15 24	21 43	1 07
31st.	15 22	20 48	0 41

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On the 16th it reaches greatest its elongation east of the sun 24° 43′. Its apparent diameter on the 1st is 5.5″ and on the 31st 8.9″.

VENUS.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Passage.
1st.	10h. 28m.	10° 34′	9h. 47m. A. M.
5th.	10 46	8 55	9 49
10th.	11 09	6 45	9 52
15th.	11 32	4 29	9 55
20th.	11 55	2 09	9 58
25th.	12 17	0 12 S	10 02
31st.	12 45	3 04	10 05

She will be to the west of the sun during the entire month, and in a favorable position for morning observation. The apparent diameter is slowly decreasing on the 15th it is 12.4″.

MARS.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Passage.
1st.	6h. 15m.	23° 32′	5h. 32m. A. M.
10th.	6 31	23 38	5 12
20th.	6 47	23 43	4 48
31st.	7 00	23 51	4 17

The apparent diameter on 15th is 11.1″ and is slowly increasing. It will rise on the 1st at 10h. 09m. P. M., and on the 31st at 8h. 55m. P. M.

JUPITER.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Passage.
1st.	3h. 34m.	18° 02′	2h. 50m. A. M.
10th.	3 32	17 52	2 12
20th.	3 28	17 37	1 28
31st.	3 23	17 18	0 40

Phenomena presented by its four satellites. The time used being Kansas City, M. S. T.

DATE.	PHENOMENA.	DATE.	PHENOMENA.
1st, 9:27 p. m.	Europa, Sh. In.	4th, 3:44 a. m.	Io, Sh. Eg.
11:28 p. m.	Europa, Tr. In.	4:40 a. m.	Io, Tr. Eg.
2d, 0:04 a. m.	Europa, Sh. Eg.	10:41 p. m.	Io, Ec. Dis.
10:39 p. m.	Ganymede, Ec. Dis.	5th, 1:47 a. m.	Io, Oc. Re.
3d, 0:12 a. m.	Ganymede, Ec. Re.	8:00 p. m.	Io, Sh. In.
2:46 a. m.	Ganymede, Oc. Dis.	8:55 p. m.	Io, Tr. In.
3:56 a. m.	Ganymede, Oc. Re.	10:12 p. m.	Io, Sh. Eg.
9:03 p. m.	Europa, Oc. Re.	11:06 p. m.	Io, Tr. Eg.
4th, 1:32 a. m.	Io, Sh. In.	6th, 8:13 p. m.	Io, Oc. Re.
2:29 a. m.	Io, Tr. In.	9th, 0:03 a. m.	Europa, Sh. In.

DATE.		PHENOMENA.	
9th,	1:48 a. m.	Europa,	Tr. In.
	2:40 a. m.	Europa,	Sh. Eg.
	4:20 a. m.	Europa,	Tr. Eg.
10th,	2:40 a. m.	Ganymede,	Ec. Dis.
	4:13 a. m.	Ganymede,	Ec. Re.
	7:12 p. m.	Europa,	Ec. Dis.
	11:22 p. m.	Europa,	Oc. Re
11th,	3:26 a. m.	Io,	Sh. In.
	4:15 a. m.	Io,	Tr. In.
12th,	0:35 a. m.	Io,	Ec. Dis.
	9:45 p. m.	Io,	Sh. In.
	10:41 p. m.	Io,	Tr. In.
13th,	0:07 a. m.	Io,	Sh. Eg.
	0:52 a m.	Io,	Tr. Eg.
	7:04 p. m.	Io,	Ec. Dis.
	8:09 p. m.	Ganymede,	Tr. In.
	9:18 p. m.	Ganymede,	Tr. Eg.
	9:59 p. m.	Io,	Oc Re.
14th,	7:18 p. m.	Io,	Tr. Eg.
16th,	2:40 a m.	Europa,	Sh. In.
	4:06 a. m.	Europa,	Tr. In.
	5:17 a. m.	Europa,	Sh. Eg.
17th,	9 47 p. m.	Europa,	Ec. Dis.
18th,	1:39 a. m.	Europa,	Oc. Re.
19th,	2:30 a. m.	Io,	Ec. Dis.
	5:18 a. m.	Io,	Oc. Re.
	6:35 p. m.	Europa,	Sh. Eg.
	7:48 p. m.	Europa,	Tr. Eg.
	11:48 p. m.	Io,	Sh. In.
20th,	0:26 a. m.	Io,	Tr. In.
	2:00 a. m.	Io,	Sh. Eg.
	2:36 a. m.	Io,	Tr. Eg.
	8:46 p. m.	Ganymede,	Sh. In.
	8:59 p. m.	Io,	Ec. Dis.

DATE.		PHENOMENA.	
20th,	10:36 p. m.	Ganymede,	Sh. Eg.
	11:30 p. m.	Ganymede,	Tr. In.
	11:44 p. m.	Io,	Oc. Re.
21st,	0:40 a. m.	Ganymede,	Tr. Eg.
	6:52 p. m.	Io,	Tr. In.
	8:29 p. m.	Io,	Sh. Eg.
	9:02 p. m.	Io,	Tr. Eg.
22d,	6:10 p. m.	Io,	Oc. Re.
25th,	0:22 a. m.	Europa,	Ec. Dis.
	3:54 a. m.	Europa,	Oc. Re.
26th,	4:33 a. m.	Io,	Ec. Dis.
	6:35 p. m.	Europa,	Sh. In.
	7:31 p. m.	Europa,	Tr. In.
	9:12 p. m.	Europa,	Sh. Eg.
	10:04 p. m.	Europa,	Tr. Eg.
27th,	1:43 a m.	Io,	Sh. In.
	2:10 a. m.	Io,	Tr. In.
	3:54 a. m.	Io,	Sh. Eg.
	4:20 a. m.	Io,	Tr. Eg.
	10:53 p. m.	Io,	Eg. Dis.
28th,	00:47 a. m.	Ganymede,	Sh. In.
	1:28 a. m.	Io,	Oc. Re.
	2:36 a. m.	Ganymede,	Sh. Eg.
	2:48 a. m.	Ganymede,	Tr. In.
	3:58 a. m.	Ganymede,	Tr. Eg.
	8:11 p. m.	Io,	Sh. In.
	8:35 p. m.	Io,	Tr. In.
	10:23 p. m.	Io,	Sh. Eg.
	10:46 p. m.	Io,	Tr. Eg.
29th,	7:54 p. m.	Io,	Oc. Re.
31st,	5:25 p. m.	Ganymede,	Oc. Re.
32d,	2:58 a. m.	Europa,	Ec. Dis.
	6:08 a. m.	Europa,	Oc. Re.

In. denotes ingress; Eg. egress; Dis. disappearance; Re. reappearance; Ec. eclipse; Oc. occultation; Tr. transit of the satellite; Sh. transit of the shadow.

SATURN.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Passage.
1st.	2h. 38m.	12° 41′	1h. 54m. A. M.
10th.	2 36	12 29	1 16
20th.	2 33	12 15	0 33
31st.	2 29	11 58	11 47 P. M.

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THE APPARENT ELEMENTS OF THE RING.

Outer major axis 45″, minor 15″. Inclination of northern semi-minor axis to circle of declination from north to east 22′. The elevation of the earth above the plane of the ring 19° 35′, elevation of the sun 18° 58′. Earth's longitude from Saturn counted on plane of ring from the ring's ascending node on equator 92° 58′, ecliptic 50° 13′.

URANUS.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Passage.
1st.	11h. 9m.	6° 19′	10h. 22m. A. M.
31st.	11 14	5 43	8 34

NEPTUNE.

Date.	Right Ascension.	Declination N.	M. T. of Meridian Passage.
1st.	2h. 56m.	14° 55′	2h. 12m. A. M.
31st.	2 53	14 41	0 11

PHENOMENA.

On the 9th at 7:36 A. M., conjunction of Saturn and the Moon. Saturn south 5° 19′.

On the 9th at 4:00 P. M., conjunction of Neptune and the Moon. Neptune south 3° 59′.

On the 10th at 3:00 P. M., conjunction of Uranus and Venus. Venus north 0° 32′.

On the 13th at 5:45 P. M., conjunction of Mars and the Moon. Mars north 2° 56′.

On the 16th at 8:00 A. M., Mercury's greatest elongation, east 45° 43′.

On the 19th at 3:07 P. M., conjunction of Uranus and the Moon. Uranus north 6° 19′.

On the 20th at 2:00 P. M., conjunction of Venus and the Moon. Venus north 6° 48′.

On the 24th at 3:05 P. M., conjunction of Mercury and the Moon. Mercury south 1° 19′.

On the 27th, Mercury stationary in righ ascension.

On the 31st at 11:00 A. M., opposition of Saturn and the Sun.

The Moon makes 17 occultations during the month. 2 on the 3d, 1 on the 4th, 4 on the 5th, 1 on the 9th, 3 on the 10th, 3 on the 11th, 1 on the 18th, 29th and 31st.

AN UNUSUAL AND STARTLING CELESTIAL PHENOMENON.

Shortly after sunset, Monday, September 12th, the attention of people upon the streets was drawn to one of the most singular displays in the heavens ever witnessed. Directly overhead, as far as the view was unbroken by buildings, appeared a clearly defined belt of light, almost milk white, and apparently about twelve degrees in width. The view of the phenomenon from the street was, of course, greatly obstructed, and the excitement was so great that the tops of buildings were soon well filled by wildly speculating, and in many instances, frightened citizens. Following closely as the phenomenon did upon the peculiar atmospheric disturbance of a week ago, it gave rise to apprehension in the minds of many who, under ordinary circumstances, would have looked upon it only with surprise. Viewed from an eminence, the apparition presented a wonderful spectacle. From the eastern horizon to the western, it stretched in an unbroken line, its edges as definite as those of a gayly-colored ribbon. Although it was as white as pure smoke sometimes appears, it had a peculiar life-like appearance that smoke never has, and seemed to emit a ghostly light. No two persons who viewed it seemed to have the same idea in regard to it. One man with whom a reporter talked, asserted that he had witnessed something almost like it just before the war; another—an old gray-haired man—gazed at it in wonder, and said that he had never seen anything to be compared with it; a third thought it was the tail of one of the many comets that have appeared of late, while a fourth asserted that it was an aurora. Determined to fathom the mystery, if possible, an *Argus* reporter hastened toward the Dudley Observatory at about 8:30 o'clock, when the phenomenon had almost disappeared. As he climbed the hill leading to that institution, the only traces of the apparition that remained were directly overhead, and formed two sides of a triangle, the point seeming to be in the zenith. By the time he reached the observatory all traces had disappeared. Prof. Boss was unfortunately found to be out of the city. In answer to the reporter's ring at the door, one of the professor's assistants appeared. He wore an excited look, and upon being interrogated it was found that he had completed an observation of the phenomenon.

"At eight o'clock I first saw it, and its effect was absolutely startling. It spanned the heavens from east to west, and seemed of very nearly equal breadth the whole distance. It was sharply defined. At its southern edge it extended from the horizon through Zeta and Delta Bootes; thence through Nu Pi Hercules, to and through Alpha Lyra. From that point it extended to the south of the Great Square in Pegasus. The northern branch in the east extended up through the head of Draco, and there seemed to be a strong ray of light, very marked, continuing from Gamma Bootes, while around to the north there were several

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parallel streaks inclined at an angle of fifty degrees, with the general motion of the phenomenon. Three or four of these were noticed near the head of Draco. At 8:30 it was observed to clear away on the zenith. The eastern portion now consisted of a narrow strip, very bright, clearly marked at the edges, extending from Gamma Pisces through Alpha Lyra, and at the same time seeming to be moving southwest, it being about thirty degrees from the zenith and appearing to roll like columns of smoke spirally towards the west. At 8:33, in the east were two parallel streaks, the northern, the heavier and the southern throwing out diverging lines of light that seemed to gradually curve as they approached the zenith. At 8:35 o'clock the main branches separated at the zenith, while the western one was very narrow, extending through the Northern Crown. A small line of light now extended from a point about three degrees north of Alpha Lyra to a point about seven degrees from Ela Ursa Major. At 8:39 a brighter streak appeared between Alpha Lyra and Ursa Major, while that over the Crown was broken up into a series of parallel, smaller and fainter streaks. The eastern branch was now very faint and narrow, and extended nearly from Pi Pisces to Alpha Lyra, while all along the northern horizon was a bright rosy glow like the northern lights, but brightest towards the west. At 8:45 the phenomenon presented a faint, yet beautiful appearance, and at 8:55 it had vanished."

"I have not the courage to make any assertion in the matter. It may have been an aurora, but so far as my knowledge goes, it was something unique."

Manager Uline, of the telephone exchange, says that it was not an aurora, as during an aurora the telephone wires exhibit a disturbance, while on the night aforesaid they worked all right. In the name of this wonderfully-marked year, what was it? Similar phenomena were observed at Utica, N. Y., Boston, Mass., and Hanover, N. H.—*The Argus, Albany, N. Y.*

PHILOSOPHY.

CREATIONAL PROGRESS.

BY PROF. H. A. REID, SEC'Y STATE ACADEMY OF SCIENCES AT DES MOINES, IOWA.

The very nature and constitution of the human mind is such, that no man can talk or even think about his own existence and that of the visible world of objects around him, without *assuming*, even though he may deny it in words, the idea and the fact of a Great First Cause—or, as Herbert Spencer now phrases it, "the inscrutable universal power." I, therefore, maintain that *a real atheist* is a phenomenal impossibility; the *existence of God* is simply an eternal fact—but men's ideas *about God* are various and changeful. Then, without attempting to

define how, what, or where God is, I assume the general fact to be an eternal fact; and therefore the "laws of nature," so-called, are simply *the mode* of God's direct and directing energies in creation and providence. A few of those laws of nature man has already learned something about; vastly more of them still "move in a mysterious way, their wonders to perform;" but none of God's laws are too secret or too sacred for man's reverent and most searching inquiry.

I next present the Synoptic Calendar of Creation, which is a companion piece to the Psychic Calendar, given in the REVIEW of September, page 264, and also of the Zoic Calendar, given in the REVIEW for July, page 138. The object of these calendars is to show in a plain, perspicuous, and easily comprehended way, how naturally the discoveries, the deductions and the logical sequences of modern science do supplement and confirm what has been *revealed* in the Hebrew and Christian Bible for thousands of years.

THE SYNOPTIC CALENDAR OF CREATION.

Calendar to be read from the bottom upward.

THE SPIRITUAL *KINGDOM.*	God, angels, "ministering spirits," and "the spiritual man" of the Bible—that is, those endowed with that faculty or spiritual sense (the "sixth sense" of my Psychic Calendar) whereby they discern God as a spirit, and "worship him in spirit and in truth."
THE ANIMAL *KINGDOM.*	All forms and conditions of animal tissue or animal product, including animal man, or "the carnal man" of the Bible.
THE VEGETABLE *KINGDOM.*	All vegetable growths, substances and products.
THE MINERAL *KINGDOM.*	Every solid and fluvial substance that is not or has not been a vitalized part of any vivific structure.
THE ELEMENTAL *KINGDOM.*	Preterrestrial elements, or nebulous and gasiform matter which ultimately condensed and formed the gaseous, fluviatile and solid substances composing our world.

The above schedule, followed from the bottom upward, shows the order of creational progress, each "kingdom" being evolved or created out of not only the last preceding one, but doubtless in some measure from all the preceding—not that "the spiritual kingdom" is thus produced, in all that it comprehends, but that the "spiritual man," after he has become cognizant of God and spiritual things, still dwells in the flesh for a time, and is therefore a "connecting link" between the animal kingdom and the spiritual kingdom*; or, the animal form of man walking the earth, but the angel consciousness more or less developed within his soul. This is the natural philosophy of that sentiment,

"I want to be an angel, and with the angels stand,"

and others like it, so common in our church and Sunday school hymn books.

* See a very remarkable article bearing on this subject, written by Rev. F. H. Hedge, D. D., of Harvard University, and entitled "Ghost Seeing," in the *North American Review* for September, 1881.

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Thus, modern science and the doctrine of evolution cast in their evidence to authenticate and confirm as good and true, because reaching in the direction of creational progress, that rich element in our Christian hymnology.

I next present the "Mosaic Calendar of Creation," day by day, with the correlative facts of creational progress as taught by modern science:

THE MOSAIC CALENDAR OF CREATION.

Creational periods or epochs as given in the first chapter of Genesis; and the corresponding eras and facts in evolution, as taught by modern science.

By H. A. REID, *Sec'y Iowa State Academy of Sciences*

To illustrate his lectures on "EVOLUTION," "SCIENCE AND THE BIBLE," etc., approved and commended by the State Executive Committee of the YOUNG MEN'S CHRISTIAN ASSOCIATIONS OF IOWA.

☞ Take your Bible and trace the record through.

"In the beginning,' *Verse* 1-2	Primeval chaos, or the cosmical-nebular condition of the matter which now composes our solar system. [Infinite space already flecked with other nebulæ and systems of worlds.]
1st Day. *Verse* 3 *to* 5	Nucleal rotation, by which light and darkness (cosmical light), were differentiated in our nebulous mass, first in the whole mass of our solar system, and subsequently in each planetary mass in its turn.
2nd Day. *Verse* 6 *to* 8	A fire crust is formed, with hot, seething, fuming waters upon it, then an interspace or "firmament" of superheated air, then a thick, black sea of vapor or cloud-waters above.
3rd Day. *Ver.* 9 *to* 13	The cooling globe contracts, thus forming wrinkles in its crust; then the depressions become seas and the elevations dry land, and vegetation begins to appear.
4th Day. *Ver.* 14 *to* 19	The thick, vapory cloud-sea ("waters above the firmament") of the second day has become more rarefied, and broken into patches of cloud, so that sun, moon and stars can now shine through upon the earth.
5th Day. *Ver.* 20 *to* 23	Huge water animals ("great whales") the ichthyosaurus, etc., besides walking and flying reptiles and primitive birds, now appear.
6th Day. *Ver.* 24 *to* 31	Mammals, "beasts of the earth, and cattle," etc., and also masterful Man, now appear. [*This completes the physical creation, ready for the spiritual to begin.*]
7th Day. *Chap. II. Verse* 1, 2, 3	Sabbath: the spiritual day or era, during which the "spiritual sense" has been and still is being evolved and differentiated in man, as indicated all through the Bible, and perfected in JESUS CHRIST, the culminant Son of Man and the initial Son of God. Hence it is holy or hallowed time—the creational period of *spiritual* as distinguished from mere animal life.

"The evening and the morning" for epochal culmination and decline) is recited for each day, down to the seventh; but here it is omitted—thus explicitly indicating that the seventh "day" or creational era is still in progress.

A brief account of how I was first led to construct this calendar will serve to explain it. Twenty-one or twenty-two years ago Charles Darwin's great work, "The Origin of Species," was first published, and, for several years following, the doctrine of evolution was kept in high debate. One strong argument, and which was considered "a clincher" against evolution, was this: Birds and reptiles are so utterly unlike in their structure and modes of life—the one wallowing in mire-gulfs of oozy slime, while the other soars away in free ærial flight—that there can never be any evolutional connection between these two classes of animals. Yet, within a decade were discovered the fossil archæopteryx, ramphorhyncus, compsognathus, pteranodon, ichthyornis, and the whole family of *Dinosaurs* or biped reptiles with hollow bones, gravel-grinding gizzards, and other ornithic characters, till the list of bird-like reptiles and reptilian birds became so full that no scientist could any longer dispute the completeness of the proof that the bird type of animals was evolved from the reptile type. (See geological chart, in REVIEW for July, page 138, at "Age of Reptiles.") While studying this matter, it occurred to me that the Bible account of creation mentioned moving creatures of the water and fowls that fly above the earth as having been created on the same "day." I re-examined the old Book, and found that Gen. 1:20, 21, was a most remarkable synopsis of the latest facts discovered by modern science, to-wit: the co-ordinate origin of reptiles and birds. The passage is so striking that I will quote it:

"And God said, let the waters bring forth abundantly the moving [or creeping] creature that hath life, and fowl that may fly above the earth in the open firmament of heaven. And God created great whales, and every living creature that moveth *which the waters brought forth abundantly*, after their kind, and every winged fowl after his kind;" etc.

Vegetation had been created before this, or on the third "day" so called, and land animals appear the next or sixth "day," corresponding to the "Age of Mammals;" so that there can be no mistaking the fact that the Bible writer definitely groups the water animals, including fishes, amphibians and reptiles, together with flying creatures and birds, in one creational period or epoch, just as modern science does. And from this starting point I followed the whole matter through each way, and constructed my "Mosaic Calendar."

Let another point be observed. The Bible brings man in on the sixth "day," in common with the "beasts of the earth;" it gives him "dominion over them" —that is, designated him as the superior creature; but that is all, and the sixth "day" closes. Now, mark, it is after the "seventh day" has opened that man is spoken of as becoming a "living soul;" as giving names to the animals—the beginning of language; as being man and wife—the beginning of the family, instead of tribing or herding together; as having a consciousness of God—the beginning of the spiritual sense; and so on.

Now, what are the modern facts? Why, we are assured by competent scientists that relicts of man's existence beyond question have been found as low down as the middle tertiary, or age of mammals, in the geological scale; and that man's origin, in whatever mode it may have occurred, was contemporaneous with that of other mammals—that is, within the same creational or evolutional period. And that is in essence just what the Bible sets forth as the work of the sixth "day." Indeed, there is a vast deal of bottom truth in the old Book yet, which is worth digging for; and although science does not stop nor turn aside to serve the exigencies of any particular theological system, it is nevertheless both interesting and profitable to note how perfectly the most advanced scientific thought of our day, in regard to creational progress, accords with what is revealed and taught in The Book of books.

SCIENCE TEACHING.

BY PROF. S. H. TROWBRIDGE, GLASGOW, MO.

It is much easier to remain in a rut than to extricate one's self from it. But often the end is worthy of the effort. While I would not assert that all methods of teaching run in ruts, I hesitate not to say that the common text-book method of teaching science is in a most deep and dangerous rut. The *only* way to become acquainted with nature is to study nature herself. On account of repeated failures in the past to convince educators and school boards that this is true,

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and the vast importance of the subject which forbids cessation, or wavering, of effort, even in the face of conscious defeat, I am constrained to reiterate some statements often made and to reinforce them with copious quotations from others who know from experience whereof they affirm, and whose views are worthy of consideration and acceptance.

While faith, in many things, is a most commendable and essential virtue, unquestioning faith in the statements made by authors of text-books and lectures in regard to phenomena of nature has in it more of weakness and servitude than of wisdom. Prof. Huxley says in regard to physical science: "Mere text-book work is a sham and a delusion." The committee*, on science teaching, of the American Association for the Advancement of Science, after quoting a remark of Huxley, that he "would not raise a finger to introduce more book-work into every art curriculum in the country," say: "We concur in this view as applied to the present science teaching in our public schools. We would not raise a finger to extend it." The advancement of science is so rapid that text-books, even the best, as Prof. Agassiz has said, "are already antiquated by the time they leave the press." Agassiz further says: "When we study books we are prone to remove away from the thing we study. A student of nature should, therefore, be trained at once in the difficult art of reading for himself in the great book of nature." He was accustomed to say to his pupils: "I hope you have brought no books, for I don't want you to read." Dr. Jas. LeConte, of the State University of California, says: "While a lecturer in the class-room or on the public platform may teach correct science as accepted at the time, his field is not so extended and his time so limited that he cannot keep pace with it, and thus be compelled unwittingly to teach error, as is usually the case—he cannot bring it to the full comprehension of his hearers by mere word of mouth." Dr. Whewell says: "The knowledge of which I speak must be a knowledge of things, and not merely the names of things; an acquaintance with the operations and products of nature, and not what has been *said* of them." Quoit asserts that "the bane of our school work is the confounding of knowledge with memorizing" "Cram has been defined by an English lexicographer, as a species of intellectual feeding which is neither preceded by appetite nor followed by digestion." "The value of educational systems consists simply in what they do to incite the pupil to help himself. Mechanical school-work can give instruction, but it cannot develop faculty because this depends upon self-exertion. Science, if rightly pursued, is the most valuable school of self-instruction." Committee of A. A. A. S. "Judicious oral assistance, as in the physical, chemical, or natural history laboratory, given by a competent master to a pupil at work, is invaluable for stimulus and guidance; but the aid must be discreet and the skillful teacher will not talk too much. But where it is all talk and no work, and text-books are filtered through the very imperfect medium of the ordinary teacher's mind, and the pupil has nothing to do but to be instructed, every sound principle of education is out-

* This committee consists of E. L. Youmans, A. R. Grote, J. W. Powell, N. S. Shaler and J. S. Newberry.

raged and science is only made ridiculous." Committee of A. A. A. S. "The pupil must actually see nature in all her manifold developments, or he cannot understand her. No natural science, and especially geology, can be taught in any other way. In vain our professors attempt to describe, and the students to comprehend, without a tangible illustration."

A striking illustration of this occurred, a few years ago, in Agassiz's Museum itself, about the last place on this continent where such a thing should have taken place, but it shows the sad need of *time*, even when the specimens are at hand, to make the necessary preparations and present to the eye all the animal structure to be studied in a good course in zoölogy: A diagram of large size was thoroughly explained by the professor and exhaustively discussed, as showing the internal structure of the animal in question. After the students had made their copious notes, and gained a good knowledge of the supposed monstrous animal, they were not a little surprised, when the fact afterwards became incidentally known, that the object of their interest and study was too small to be seen without a powerful microscope. A similar proof came in my own experience. A few years ago, after a peculiarly bright class in geology had learned and recited well about the monstrous animals of the Quaternary Age, giving names, descriptions, and dimensions with satisfactory minuteness, I had the good fortune to come in possession of a large amount of mastodon remains, from within sight of the college recitation room. On showing the specimen and giving its name, I was painfully but thoroughly convinced, by the blank expression of the whole class, that not one of them had any just conception of the size or peculiarities of the animal they had so glibly described. These things and many others, demonstrate the truth of Mr. Agassiz's statement that, "the pupil studies nature in the school-room and when he goes out of doors he cannot find her." "This mode of teaching," says a committee of the American Association, "which is by no mens confined to the public schools has been condemned in the most unsparing manner by all eminent scientific men as a 'deception,' a 'fraud,' an 'outrage upon the minds of the young,' and 'an imposture on education.'"

The best place to study science is in the field. To get the greatest good from objects of nature the student, and not less the teacher, must collect them himself, so he may know their habitats and surroundings, whether they are solitary or gregarious in their habits, their associations with other animals, etc. As, however, facilities for comparative study of allied forms are not usually found in chance gatherings from day to day, these should be supplemented by *collections*, carefully arranged and correctly labeled, to which the student has free and ready access at all times.

"I confidently assert that any institution which undertakes to teach geology can no more afford to dispense with them than it can with blackboards, crayons, test-tubes, and air pumps."—Alex. Winchell, D. D., Michigan State University.

"It would be folly for any one pretending to teach geology not to make use of them."—President Hitchcock, Amherst College.

Dr. LeConte, of California, says: "Natural History cannot be taught without laboratories, museums, aquariums, and zoological and botanical gardens, all of which are expensive. Nor can it be taught except in small classes, by direct personal contact of teachers with pupil and both with nature; and this requires much time and a superior order of teachers."

It has been well said that the chief business of the naturalist at the present time is to *know how to compare and observe*. Prof. Crosby has said: "The great want of educational system is method and not knowledge." To meet this want, it may be said that among all of value the lamented Agassiz has contributed to science, there is perhaps nothing more valuable than his method of instruction. His object was to develop professional naturalists, and to teach his students to observe and think for themselves, the first requisites to an acquaintance with nature. At first a specimen was placed in the student's hands with no other instruction than that he find out by inspection all he can about it, and express the information he gains by drawing and describing it. To each student, as far as possible, was given a different subject, in order that he might work independently. As soon as he showed himself capable, he was set to work on some special problem in connection with his subject, in which he was to determine, by rigid comparison, its relations to other and similar forms. Each individual was closely watched in his work and asked to give reasons for all the conclusions he reached. Every erroneous one was corrected and every correct one confirmed, and he was thus led to the discovery of important truths, and not unfrequently, though erroneously, took the credit to himself. It was Agassiz's practice to lay before his students everything he was doing; to speak freely in their presence of all his scientific plans and aims; to admit them as participants in all his investigations, and even to call them by the flattering appellation of fellow investigators.

"I am convinced," says Burke, "that that method of instruction which most nearly approaches methods of investigation is the true method." "It was Bacon who advanced and stoutly defended the view that science teaching in our schools should be intuitional, living, and practical."

Study of nature cannot commence too young. Children are born naturalists, and if their childish curiosity can be encouraged and their questions satisfactorily answered, they will begin life as investigators and students of nature, and their interest in it and profit from it will increase through life. In nature they find object-lessons of amazing attractiveness and beauty everywhere and always before them. These will afford, to a thoughtful child, amusement and entertainment not only more profitable but more pleasing than frivolity. In school work, so far as practicable, each topic in science should be pursued three times during the course of study: *First*, in the primary department, where the object should be to interest the opening mind in the familiar objects of nature, and to teach the habit of observation. *Second*, in the preparatory school, where the work of classification and memorizing is to be performed at an age when memory is more plastic and impressible than ever afterward, and when the powers of observation and rapid comparison are most acute. So that—*Third*—in college course, the

student, with maturer mind, may be prepared to investigate the reasons, the causes, and the laws which underlie the facts he has previously learned. "We aim," says the committee of the Scientific Association, "to advance science by the promotion of original investigation, which depends upon men prepared for the work; do the schools of the nation, by their modes of scientific study, favor or hinder this object? Do they foster the early mental tendencies that lead to original thought; or do they thwart and express them? We have an undoubted concern in this matter, and it is, moreover, strictly identical with that of the community at large; for there can be no better test than this of the real character of a school system. When we ask whether a mode of teaching and a manner of study are calculated to awaken the spirit of inquiry, to cultivate the habit of investigation, and rouse independent thought, our question goes to the root of all true education." An attempt to study nature without abundant illustrations from nature would be like the effort of a dentist, a carpenter, or a farmer to ply his profession or trade without the use of tools or machinery. The tools of a student of nature are collections of natural objects systematically arranged, and these, like all machinery, facilitate labor and increase productiveness. But their object, it should be remembered, is not to make acquisition of knowledge in natural history easy, but to make it possible.

ARCHÆOLOGY.

ODE TO THE MOUND GRAVES.

BY JOHN EDWARDS, OF MARYVILLE, MISSOURI.

I.

Beneath the mould of this unstoried heap,
Close wrapt in coffins of their kindred clay,
Hushed in th' embrace of death's cold, dreamless sleep,
While untold years above them fleet away,
Like the winged moments of the short lived day,
May haply rest some nation's glorious dead,
Consigned to dark oblivion and decay,—
Save that poor pride hath made them here a bed,
That lifts above the common clod its turf-crowned head.

II.

The warrior here hath wrapt him in his shroud,
That shroud whose woof, though strong of old, I ween,
Now melts within the breath like the dim cloud

That fades before the daylight's ardent beam.
Sleep on! though in your sepulchre no dream
Of the to-morrow shall wake you again,
Nor in your eyes reanimate the gleam
Of passion's fire, as once the voice of fame,
To win on sanguine fields of war for you a deathless name.

III.

Ah! Could ye from this tenement arise,
Incarnate, as of old, with vocal tongue,
Some race of yore, mayhap, might greet mine eyes,
Untold in fable and by muse unsung,
Who, when the sires of these old oaks were young,
Whose deep'ning roots amid your bones have crept,
And o'er your tomb their hoary branches flung,
Their haunts in these wild vales and forests kept,
Or o'er these hills, with bow and lance, on martial errands swept.

IV.

No harp of muse can to my listening ear,
From the far, dim oblivion of the past,
Call up the story of the race who here,
Deep pillowed, sleep death's sleep, the last,
Ere from the grave awakened by the blast
And loud *reveille* of that trumpet's peal,
Each quickened ghost shall rising stand aghast,
And e'en the bosom of this pile shall feel
The tramp, and from its dusty depths its dead reveal.

THE ALPHABET IN PREHISTORIC AMERICA.

At the recent Science Convention, at Cincinnati, Major Wm. S. Beebe, of Brooklyn, read a very suggestive paper on the inscribed records of the Mound Builders, especially those discovered at Piqua, Ohio, and Davenport, Iowa. The former were on tablets of earthernware, but the latter inscribed slates. On the Piqua tablets the characters are in horizontal lines, and in four of these lines they were, in each case, six in number. In the fifth and remaining in-instance there were five, but this arrangement was some distance, in the longitudinal direction of the tablet, from the group first mentioned, which were in both cases written in couples.

One of the Davenport slates was inscribed on one side, the other on both. The stone inscribed on but side bore on its surface a series of codcentric circles. Between the outer two of these were twelve equi-distant signs, presumably the

zodiacal signs. The slate had two perforations on one of its edges, evidently for suspension.

Major Beebe claimed that the Piqua inscriptions are the names of the eight zodiacal signs on the Davenport slate, excepting Capricornus, Aries, Cancer, and Libra, which four signs are represented by four initial letters on the back of one of the Piqua tablets, and which representing the north, west, south, and east respectively, and corresponding to the Tucatec Bacobs, or world holders, as they were called, and to which a peculiar importance is attached.

The forms of the Piqua letters are almost precisely those that occur about the Mediterranean, and whose phonetic values have been determined by Alois Hess. Major Beebe believes that he has been able to trace each form of letter to aboriginal American picture symbols, in which the same significance obtains in both European and American forms. Having fixed the significance of these letters, he has, he says, deciphered the inscription on the stone from the Grave Creek Mound, West Virginia, and that on the Pemberton ax In all these cases the names deciphered refer to certain stellar combinations, and in the case of the slates and tables, which are perforated, were probably in the nature of charms. In the case of the Pemberton ax part of the inscription is read with edge of the ax up, the remainder with the edge down, and this inscription, too, probably, had reference to some rite or species of devination in which the ax played an important part.

A very significant feature in regard to this ax is, that the names read on the ax, when held with the edge up and down, have been preserved with the change of but one letter by an Esquimau tribe in Northwest America as the names of good and evil respectively, whereas the ax itself was found at Pemberton, N. J. The generally prevalent idea as to the relation of the Esquimaux and pre-glacial man makes this incident peculiarly suggestive.—*Scientific American.*

GEOLOGY.

FOSSIL FORESTS OF YELLOWSTONE PARK.

As explorations of the fossils forests of the Park have each succeeding year greatly added to our knowledge of their area, magnitude and wonders, during the past year I explored the hitherto unknown forests on Cañon Creek and other localities of the Yellowstone Range, Mount Washburn, and the basaltic range between the fingers of the Yellowstone Lake; also those in the mountains east of it, in the Hoodoo region, and on the Stephens Range, besides many additional localities on the Pelican and Warm Springs Creeks, as well as other well-known forests.

It is now evident that the basins of the East Fork of the Yellowstone, Pelican, Tower, and Black Tail Creeks, constitute a region of fossil forests where an excavation or erosion at an elevation of from 7,000 to 10,000 feet would most lilely unearth the fossilized branches, trunks, and roots of the giant trees of some primeval forest. Whether the successive deposits now encasing these forests in some portions of the Park to a vertical depth, of at least 4,000 feet are subaquous or subaërial, or, as is probable, partly both, it is evident that great and long-continued oscillation of the surface and periods of submergence and elevation have occurred, as the roots of the fossil trees of these forests, little inferior in size to the "big trees" of California, often penetrate nearly, if not quite, through the horizontal stratum or layer of earth and rock upon which they grew, into the broken, shattered, and eroded trunks of the fossil trees beneath them. It is also evident, from the uniform character of the successive forests in vertical layers that the agents or influences for fossilization were for an immense period of time uniform and abundant, while those for crystalizing, though long continued, were at no period so abundant or uniformly distributed. In fact, it is not usually the largest trees, or forests of them, which are other than simply fossilized in the original forms of the timber but, rather, limited areas of usually smaller and more scattering timber, originally cnncealed in the peculiar cements which fills every crack and cavity, not only of the wood but also of the incasing rocks and their interstices, with the most beautiful chalcdony, which, probbaly, after long-continued processes of cooling, has produced the famous caskets of brilliant amethysts and other crystals here found, and which, while elsewhere unequaled in nature, are considered inimitable by art.—*U. S. Geo. Rep.*

MEDICINE AND HYGIENE.

THE ATTENUATION OF VIRUS.

So long as vaccination stood alone, the alleged prevention of a malignant disease by the voluntary production of a mild disease of similar type being a fact unique and unexplained, the anti-vaccinationists had a shadowy ground to stand on. How is it possible, they asked, to protect life and health by inviting disease? And when they boldly disputed statistics and pronounced the theory of vaccination a delusion, not a few intelligent people were confounded and prejudiced against a practice which has reduced to comparative feebleness one of the worst of the plagues of former days.

The discoveries made last year by Professor Pasteur in connection with chicken cholera, and fully described in this paper at the time, made vaccination a fact no longer unique, and gave a most promising clew to the *rationale* of its operation in making the system less vulnerable to small-pox. As our readers

will recall, that distinguished investigator of microscopic life demonstrated the living virus of chicken cholera, and proved that by suitable cultivation it could be so attenuated or shorn of its malignant quality that it would produce only a feeble disturbance of the animal organization, which yet sufficed to protect the animal as thoroughly from the more virulent disease as the latter could in case it was not fatal. More recently Professor Pasteur has investigated in a similar way the virus of the splenic fever of cattle, more widely known as anthrax and the Siberian plague; and at the late medical congress in London he gave an account of a series of discoveries in this new field, which not only add immensely to the scientific assurance of the efficiency of vaccination among men, but put into the hands of cattle owners the means of arresting a disease as destructive to domestic animals as small-pox ever was to humanity. He also demonstrates a general method of preparing virus vaccine, based on the attenuating action of oxygen and the air, which makes it probable that a virus can be prepared which, while it thoroughly protects against small-pox, will be less open to objection than humanized or even bovine virus, since the possibility of conveying at the same time any syphilitic or septic taint will be entirely obviated.

Already these investigations have resulted in the attenuation of four kinds of virus, bringing under control as many types of malignant disease.

As a proof of the protective efficiency of the attenuated virus, Professor Pasteur described the following experiment. He took fifty sheep and vaccinated twenty-five of them. A fortnight after all of the fifty were inoculated with the most virulent anthracoid microbe. The twenty-five vaccinated sheep resisted the infection; the unvaccinated twenty-five died of splenic fever within fifty hours. Within fifteen days after these results were made known more than 20,000 sheep and a large number of cattle and horses were vaccinated in and around Paris.—*Scientific American.*

LISTERINE, THE NEW ANTISEPTIC PREPARATION.

We are glad to call the attention of our readers to a new and valuable contribution to antiseptic surgery. It is called Listerine, and the thought suggesting the name is indeed a happy one. It is a combination of the essential constituents of thyme, eucalyptus, baptisia, gaultheria, and mentha arvensis. Besides these, each fluid dram contains two grains of refined and purified benzo-boracic acid. These substances, carefully prepared and combined in a solution of uniform strength, cannot fail to do good service in the treatment of all affections requiring an antiseptic.

The preparation is convenient, safe and agreeable. Locally it will be found of realy value as a dressing for wounds, ulcers, and abscesses. It may also be employed as a constituent of solutions for atomization in lung affections and of gargles in throat diseases, while internally it must prove efficacious in all forms of fermentative indigestion.

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Surgeons and physicians who have made use of any of the well-known ingredients of Listerine can attest their value, and will not fail to appreciate the advantage of having them always at hand in a suitable combination.—*Louisville Medical News.*

PULQUE.

Pulque is the national drink of the Mexicans. It is produced by the fermentation of the maguey or *Agave Americana*. This plant has been considered diuretic and antisyphilitic. There is no authenic record as to who first made pulque or neutli. Many are the traditions extant among the Mexicans concerning its first manufacturer. It seems, however, to be the more general belief that it was Xochitl, daughter of a nobleman called Papantezin, who lived in the time of Tapancaltzin, eighth king of the Toltecs. From time immemorial pulque has been considered to contain medicinal virtues in a very high degree as well as all the other products of the maguey, and at one time the maguey was even said to hold a spiritual life and was held in reverence. To-day pulque is esteemed by the ignorant classes as having a variety of curative powers, and physicians use it for its alcohollic and nutritive properties. It is held as a stiumlant, tonic and antispasmodic. They recommend it to the infirm, weak, anæmic, and nursing mothers.

It is obtained by fermenting the juice expressed from the central portion of the maguey plant. After expressing the juice between rollers, or as was formerly done by means of suction, it is carried to the vats for fermentation. These vats consist of raw ox hides loosely suspended in a strong wooden frame, with the hair on the outside. These hide-made vessels contain the cryptococcus or ferment, which is a residuum of the former fermentations. After a few hours fermentation is fully established and the pulque is drawn off, always leaving a residuum in the vessel for the next fermentation. The liquid obtained from the maguey plant has a density varying from 1.029 to 1.042 and contains in 100 parts 9.553 of sugar, 0.540 of gum and soluble albumen, 0.726 salts, and 89.181 of water holding in solution resinous matter, fats, albuminoids, starch, dextrine and glucose.

According to Don Jose Ramos, its salts contain potash, soda and lime in moderate proportions, and magnesia and alumina as chlorides, carbonates, sulphates and silicates; hence the great value in which it must have been held in former times and in which it ought to be held at the present day.

From the composition of the juice of the maguey one may have an idea of the therapeutic effects of the pulque, allowing for the change which these constituents may undergo through fermentation. Pulque has no definite proportion of alcohol, for one may readily see from the way it is manufactured that it cannot have any definite standard. It, however, contains a very small proportion of fusil oil, and carbonic acid in large quantities. Considering that its manufacture

is not based upon any standard of purity, or even with ordinary care, its density cannot be given with any certainty, though it varies from 0.9943 to 1.0200 ("La Esquela de Medicina"). To-day it is attracting the attention of the medical fraternity because of the evil effects upon the liver caused by its excessive use among the lower classes, not, however, in the light of pulque as a compound, but because of the evil effects of the alcohol which it contains. It is therefore proposed to adopt some other form of manufacture that a much lower percentage of alcohol may enter into its composition, according to a fixed standand, and thus avoid the evils of alcoholism.—*By E. E. Riopel, M. D., in the Therapeutic Gazette.*

THE TENURE OF LIFE.

An industrious German, Baron G. F. Kolb has lately compiled a book of universal statistics which furnishes much food for thought. His figures show that every advance made by a people in morality, in profitable and healthy employment, and useful knowledge brings it nearer to the ideal—the greatest natural tenure of life. Domestic virtue also tells favorably on the health and wealth of a population. Thus in Bavaria, out of 1,000 children born alive there died, of legitimate children, 248 boys and 212 girls; of illegitimate, 361 boys and 342 girls. Out of 100 children suckled by their mothers, only 18.2 died during the first year; of those nursed by wet nurses, 29.33 died; of those artificially fed, 60 died; of those brought up in institutions, 80 died in the 100. The influence of prosperity or poverty on mortality is also shown by Baron Kolb. Taking 1,000 well-to-do persons and another 1,000 of poor—after five years there remained alive of the prosperous, 943; of the poor 655. After fifty years there remained of the prosperous, 557; of the poor, 283; at seventy years of age there remained 235 of the prosperous, and of the poor, 65. The average length of life among the well-to-do was 50 years, and among the poor 32 years.

One of the most potent shorteners of life is the anxiety of providing for bare subsistence. The lack of sanitary conditions also shortens man's years. Idleness, as compared to intense industry, outweighs—prejudicially outweighs—all the advantages of ease and abundance.—*Scientific American.*

COLOR-BLINDNESS AND EDUCATION OF COLOR-SENSE.

The examination instituted by Dr. B. Joy Jeffries among the pupils in the schools of Boston (including 14,469 boys and young men, and 13,458 girls and young women) have shown that about one male person in twenty-five is color-blind, while the defect occurs with extreme rarity in girls and women (only 0.066 per cent. of the female pupils in the schools). The researches that have been

made in Europe show that a similar law as to the relative proportion of color-blindness between the sexes prevails there. The subject has been over-looked until within a few years, but the value of the knowledge of it that has been gained cannot be disputed. This knowledge can be applied practically on a scale of considerable extent in determining the vocation to which boys should be trained. A person who is color-blind is obviously unfit for any business in which he must know how to distingush colors. Yet the person himself and those who are around him are seldom aware of his defect.

If examinations are regularly made in the schools and records kept of them, as has been done by Professor Jeffries, a sure practical test may be found which can be applied directly to each person, so as to guide him aright on this point. The inquiries of Dr. Jeffries have disclosed a great lack of knowledge of colors, aside from color-blindness, among adults as well as among the boys in the schools. But very few boys of the grammar or higher schools, he says, are familiar with the color-names of even the primary colors, and still less can they correctly apply those names they do remembe, when shown colored objects. "I have received letters from adults, not color-blind, whose lack of color-names had been a serious drawback to them in their occupations in every-day life; and they have besought me to urge the teaching of color-names and the education of the color-sense in our public schools." The teaching of colors and color-names has been partly introduced into our primary schools, but without any system; it has been begun in Europe, especially in Germany, in the lowest schools, in a systematic manner.

The exemption of women from color-blindness has been attributed to their familiarity with color objects and materials; but this holds only of the sex as a whole, not with reference to individuals, for the color-sense cannot be changed with practice in colors. The question arises whether generations of color-education have caused this sexual difference, and is important; for, if answered in the affirmative, it proves that we may begin to eliminate color-blindness from future generations of boys by teaching and exercising the present generation in the perception and distinctness of colors.

DIAGNOSIS OF BLOOD-STAINS.

Dr. J. G. Richardson, of Philadelphia, gives the following summary of the results of his measurements of blood-corpuscles:

First—That in unaltered blood-stains, as ordinarily produced by the sprinkling of drops of blood upon clothing, leather, wood, metal, etc., we can, by tinting with aniline or iodine, distinguish human blood-corpuscles from those of the ox, pig, horse, sheep and goat, whenever the question is narrowed down by the circumstances of the case to these limits.

Second—By the method I have devised we can measure the size of the corpuscles, and apply the two corroborative tests of tincture of guaiacum with ozonized ether and of spectrum analysis, to a single particle of blood-clot weighing

less than one fifteen-thousandth part of a grain, a quantity barely visible to the naked eye.

Third—Hence, when an ignorant criminal attempts to explain suspicious blood-spots upon his clothing, weapons, etc., by attributing them to the ox, pig, sheep or goat, or to any of the birds used for food, we can, under favorable circumstances *absolutely disprove* his false statement, and materially aid the cause of justice by breaking down his lying defense, even if twenty years have elapsed.

Fourth—But, if the accused person ascribes the tell-tale blood to a dog, an elephant, a capybara, or any other animal in Dr. Woodward's list, it is useless to attempt to dispute his story on microscopical evidence as to the size of the blood corpuscles.

Fifth—In cases of innocent persons wrongfully accused of murder, and really stained with the blood of an ox, pig, or sheep, testimony of experts, founded upon measurement of the corpuscles, would be valuable, but less conclusive, because, under certain circumstances, human blood-corpuscles may *shrink* to the size of those of the ox, whilst under no known condition do ox or pig corpuscles *expand* to the magnitude of those in human blood.

Sixth—In order to do away with ingenious objections of lawyers that the murdered person may have been affected with some disease which altered the size of his blood disks, or that the articles of clothing, etc., upon which the stains were deposited had produced, chemically or otherwise, some similar change in their magnitudes, it is very important to obtain, promptly, stains from the fresh blood of the victim, made in the presence of witnesses, upon portions of the prisoner's clothing, or weapons analogous to those upon which suspicious red spots are found when he is arrested. When this cannot be done, spots of the murdered person's blood, sprinkled on white paper, and fragments of his lungs and kidneys, should be carefully preserved, the former by rapid drying and the latter by preservation in diluted alcohol. These little precautions, which may in any instance, prove to be of infinite importance, should be earnestly impressed upon coroners, district attorneys and policemen, throughout the civilized world.—*American Monthly Microscopical Journal*

THE LARGEST PYRAMID.

We believe it is not generally known that the largest existing pyramid rests on American soil. The Pyramid of Pueblo, in Mexico, is larger than the great Pyramid of Cheops, in Egypt. The latter covers only fourteen acres, while the Mexican one covers forty-four acres of ground and was originally 600 feet high. It is made of sun-dried brick, and is supposed to have been built 7,000 years ago.

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BOOK NOTICES.

ANNUAL REPORT OF THE REGENTS OF THE SMITHSONIAN INSTITUTION, FOR THE YEAR 1879. Octavo, pp. 631, Government Printing Office, Washington, D. C.

This Report, prepared by the able, earnest Secretary and Director, Spencer F. Baird, comprises the following points, viz:

1. Annual report of the Secretary, giving an account of the operations and condition of the establishment for the year 1879, with the statistics of collections, exchanges, etc.

2. Report of Executive Committee, exhibiting the financial affairs of the Institution, including a statement of the Smithsonian fund, the receipts and expenditures for the year 1879, and the estimates for 1880.

3. Proceedings of the Board of Regents for the session of January, 1880.

4. General appendix, consisting of scientific papers, original and selected, of interest to collaborators and correspondents of the Institution, teachers, and others engaged in the promotion of knowledge, contributed by such well known writers, explorers and original investigators as Professors E. S. Holden, Otis T. Mason, G. C. Broadhead and Franz Joseph Pisko, and Messrs. Edward H. Knight, Brainerd Mitchell, James Hough, S. T. Walker and many others, including several prominent army officers whose anthropological articles are of the highest value.

If so interesting and instructive a work were to be published by a regular publishing house and not known as a "public document" the demand for it would be unusual.

BOOK OF THE BLACK BASS. By James A. Henshall, M. D. Large 12mo, 463 pages; Cincinnati, Robt. Clarke & Co., 1881. $3.00.

It is impossible to read this book, which is devoted to a scientific and life history of the black bass and a practical treatise on angling and fly fishing, with a full description of tools, tackle and implements, and which contains scores of illustrations, without becoming convinced that Dr. Henshall is a true "brother of the angle," as well as a thoroughly informed naturalist, on this subject at least.

One hundred and ninety-one pages are given to the scientific history of the black bass, its nomenclature, morphology and physiology with instructions for stocking inland waters with this valuable and attractive food; one hundred and thirty-six to description of rods, lines, hooks, flies, baits and miscellaneous implements and one hundred to instructions and directions for angling and fly fishing

The work is attractive in appearance and style, and even the most technical parts are written in an easy and popular manner that will interest every sportsman as well as furnish valuable information to the amateur natur alist. The enthusiasm of the writer soon extends to the reader and when he lays the book down he feels that he has gained instruction and entertainment of a new and satisfactory kind and, if the information furnished is put to proper use, that he may avoid many an attack of dispepsia and other life-shortening disease.

UNDERGROUND TREASURES, HOW AND WHERE TO FIND THEM. By James Orton, A. M. 12 mo. pp. 145. Philadelphia, 1881, Henry Carey Baird & Co. $1.50.

This little work, notwithstanding its somewhat fanciful title, is a genuinely practical and useful one, being intended not for mineralogists, but for the landholder, the farmer, the miner, the laborer, even the most unscientific. It is designed to enable such to discover for themselves minerals and ores of use in the arts and thus develop the resources and ascertain the value of any particular tract of land or bed of supposed mineral. It is offered as "a key for the determination of all the useful minerals within the United States," and, being the careful production of such a student and naturalist as the late Professor Orton, there can be no question of its entire reliability in this respect.

This is a new edition carefully revised by the author and handsomely illustrated.

REPORT OF THE COMMISSIONER OF EDUCATION, 1879. Hon. John Eaton; pp. 757, octavo. Government Printing Office.

In submitting his tenth annual report, covering the year 1879, the Commissioner of Education states that the demand upon the office for information has been greater than during any previous year. The printing of circulars has been more than double, and pet the number has not been sufficient to set forth all the information desired upon important phases of education. The circulars are entitled as follows:

No. 1, 1879. Training schools for nurses.

No. 2, 1879. Papers, addresses, discussions, and other proceedings of the Department of Superintendence of the National Education Association, at the meeting held at Washington, D. C., February 4, 5, and 6, 1879; the proceedings of the Department of Superintendence of the National Education Association for 1877; and the proceedings of the conference of the presidents and other delegates of State universities and State colleges for 1877.

No. 3, 1879. The value of common school education to common labor, by Dr. Edward Jarvis, of Worcester, Mass.; together with illustrations of the same as shown by the answers to inquiries addressed to employers, workmen and observers.

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No. 4, 1879. Training schools of cookery.

No. 5, 1879. American education, as described by the French Commission to the International Exhibition of 1876.

A series of letters selected from those received during the first four months of the year indicates the character of inquiries addressed to the Office. They relate chiefly to school legislation, methods of teaching and discipline, and courses of study, or request advice and direction for the establishment and conduct of normal schools and teachers' institutes, for the creation of public schools where none exist, for the investment of school funds, etc.

The matter of the report is derived from the reports of States, Territories, and cities, of schools of all classes, and of various related institutions, as libraries and museums. The number of these correspondents increases yearly; in 1879 the total was 7,869 for the American matter alone.

The Commissioner refers to the great progress made during the year in the classification and arrangement of the Office library, whereby the current work is facilitated.

OTHER PUBLICATIONS RECEIVED.

Report of the Commissioner of the General Land Office, 1880; Report of the operations of the U. S. Life Saving Service, 1880; Diseases of the Hog and their Cause and Cure, 46 pp. 12 mo.; Constitution, list of Meetings, Officers, Committees, and Members of the American Association for the Advancement of Science for the Cincinnati Meeting, August, 1881, by F. W. Putnam, Permanent Secretary; Bulletins Nos. 1 to 6, 1881, of the Essex Institute, Salem, Mass.; The Manuscript Troano, by Prof. Cyrus Thomas; The Ancient Mounds of Illinois, by Hon. Wm. McAdams, Jr.. Otterville, Illinois; The Preparation and Use of Cements and Glue, by John Phin, pp. 58, 12 mo.

The *Student Monthly*, devoted to the interests of education in the Society of Friends at Haverford College, Pa. The Annual report of the Proceedings of the Stockholders of the Northern Pacific R. R., September 15th, 1881; The Pollination of Yucca and on Pronuba and Prodoxus, by Prof. C. V. Riley, Washington, D. C.; Proceedings of the California Acacemy of Sciences, June 6th, 1881; The State and Higher Education, by Prof. N. H. Winchell; Annual Report of the Board of Directors of the Chicago Astronomical Society, 1881; Descriptions of some New Tortricidæ (Leaf-rollers) by C. V. Riley, M. A.. Ph. D.; First Annual Report of the Astronomer at the Winchester Observatory of Yale College, 1880–81, by Leonard Waldo; A report on the Teaching of Chemistry and Physics in the United States, by Prof. F. W. Clarke, S. B., of the University of Cincinnati; Catalogue of the Phænogamous and Vascular Cryptogamous Plants of Michigan, by Charles F. Wheeler and Erwin S. Swith, Lansing, Michigan, 1881, price 50c.

Proceedings of the Polytechnic Association of the American Institute, Thos. D. Stetson, President; The Origin and Reproduction of Pine Forest by Wm. Hosea Ballou, of Evanston, Ills.; On the Ratio between Sector and Triangle in the Orbit of a Celestial Body, pp. 3, quarto, Prof. Ormond Stone, Cincinnati Observatory.

SCIENTIFIC MISCELLANY.

METEOROLOGICAL REPORT FROM AUG. 20, TO SEPT. 20, FROM OBSERVATIONS AT WASHBURN COLLEGE, TOPEKA, KAS.

BY PROF. J. T. LOVEWELL, DIRECTOR.

TEMPERATURE OF THE AIR.	Aug. 20th to Sept. 1st.	Sept. 1st to 10th.	Sept. 10th to 20th.	Mean.
MIN. AND MAX. AVERAGES.				
Min	68.0	58.7	49.3	58.7
Max	96.0	89.5	80.9	88.9
Min. and Max	81.0	74.1	64.9	73.3
Range	28.0	30.8	31.5	30.1
TRI-DAILY OBSERVATIONS.				
7 a. m.	76.4	69.8	57.8	67.7
2 p. m.	94.3	82.7	74.5	83.8
9 p. m.	80.1	72.2	62.1	71.5
Mean	83.6	73 9	64.3	73.9
RELATIVE HUMIDITY.				
7. a. m.	.68	.79	.66	.71
2 p. m.	.48	.60	.34	.47
9 p. m.	.63	.68	.64	.65
Mean	.64	.69	.58	.64
PRESSURE AS OBSERVED.				
7 a. m.	29.02	28.97	28.99	28.99
2 p. m.	28.99	28.93	28.95	28.96
9 p. m.	28.97	28.94	28.96	28.96
Mean	28.99	28.95	28.97	28.97
MILES PER HOUR OF WIND.				
7 a. m.	8.0	19.4	15.2	14.2
2 p. m.	14.8	23.6	21.2	19.9
9 p. m.	11.9	15.6	10.1	12.5
Total miles	3105	4728	3493	11326
CLOUDING BY TENTHS.				
7 a. m.	4.1	5.7	2.0	3.9
2 p. m.	4.9	5.8	2.1	4.3
9 p m.	1.3	4.6	0.9	2.2
RAIN.				
Inches	.10	1.77	0.25	2.12

Highest Barometer during the month 29.18 in., on the 8th. Lowest Barometer during the month 28.79 in., on the 16th.

Highest temperature during the month 102°, on the 27th. Lowest temperature during the month 35°, on the 17th.

Highest velocity of the wind 44 miles per hour, on the 3rd.

The usual summary by decades is given above.

THE PRACTICAL VALUE OF SCIENCE.

An orator of the present day, says the *American Journal of Science*, who firmly believes that science is the sublime teacher of all practical knowledge, has beautifully said, in one of his lofty perorations, that "reason, observation and experience constitute the holy trinity of science." Looking over the years which have elapsed since the Middle Ages, the frightful ignorance and superstition of which cover many black pages in history; when all knowledge of a scientific character was held in utter contempt, and only a few out of the many could read or write the English or any other language; when the astrologer took the place of the astronomer, and men, women and children believed in the existence of ghosts, witches, hobgoblins, and saw signs that the world was going to be speedily demolished and turned into a still blacker chaos than their wretched ignorance caused to prevail; when science lay strangled in the cradle and was threatened with instant death if it had the temerity to heave a palpable breath; in looking over the years which have made their circuit and been ushered into the realm of oblivion since then, and marking the progress of science, which was necessarily slow at first, but quickened its march, century after century, until the nineteenth was reached, when it made a sudden and grand flight upward, it would be amazing indeed if we did not behold the mighty advancement in human affairs with awe and unbounded admiration. When ignorance and superstition covered the brains of man like a black cowl, their reason was obscured and advancement was simply impossible; but when they ceased consulting oracles and having dealings with ghosts and witches, and turned their attention to the study of their surroundings, their wants as well, and how to supply them, a new light illuminated the human brain where formerly only savage instinct dwelt, and man and the world began to improve simultaneously. The knowledge of the engineer opened up canals, river channels, and gave us the railway; and these made inter-state commerce practicable, and now we have international commerce. In order to make the earth yield him a substance, man used to sweat and toil and die prematurely from hard work; but since science has given him machinery and all kinds of mechanical appliances, he finds the world to be an Elysium to live in compared with what it used to be. Science has not only enabled him to produce two blades of grass from one and make one bushel of potatoes yield a dozen bushels or more, but it has also brought the very market to his door, as it were; it has given him in geology a sure and eternal guide to all the minerals which the earth holds in its bowels, and has furnished the means of readily extracting the same. All there is of music, art and beauty has been bestowed upon us by this great benefactor

of the human race, and its shining genius is immortalized in every step forward that man has taken.

Geology doubtless has been one of the greatest aids to our race in making its marvelous progress, and of it we desire to speak more particularly. Minerals furnish the basis of nearly all the useful arts and manufactures, and had it not been for geology we never would have had any. It made the discovery that mother earth possessed within herself all the minerals of which we know anything—gold, silver, coal, zinc, lead, iron, baryta, ochre, peat, etc., and without all these, or most of them, what would our boasted progress in civilization and the arts be worth? Indeed, it is highly probable that had they remained forever hidden we would never have acquired the cheerful habit of boasting. Many a fortune has been sunk in searching and experimenting for coal, gold, lead, zinc, iron or other ores, in places where the Pyramids might be looked for with the same chance of success in finding them. Bitter experience has taught many prospectors and miners how indispensable to their success is a knowledge of geology. Late geological studies of the Hoosac Mountain have proved that millions of dollars might have been saved to the State of Massachusetts if like studies had been made before the excavation of the great Hoosac tunnel. It is asserted that enough funds were needlessly expended to pay for a complete topographical, zoölogical, geological and botanical survey of the whole commonwealth, such as no State in the Union now possesses, and such as would for ever put away the danger of similar loss in the future. Geology must determine the cost of production of the precious metals, such as gold and silver, and their probable abundance for centuries to come.

The practical value of science in its various departments is too manifestly great to be ignored by any one interested even in a small way in the grand procession of progress. Americans in particular cannot devote too much attention to the study of it in its various branches, as their national preëminence is due to their intimate and practical knowledge of all really scientific subjects, and it behooves them especially to continue to be the friends and patrons of science.—*The Manufacturer and Builder.*

THE FUTURE OF ELECTRICITY.

The remark is common enough in the mouths of the common people as well as of the scientists that the future developments of electricity, as an applied art, have been as yet only dimly foreshadowed. It is the modern miracle-worker and after the telegraph, the telephone and the phonograph. The world is very ready to receive with credence any statement of the wonderful things yet to come. The fairs which Boston is to have this Fall will give us a clear idea of the progress of the last few years, and this department will not be equaled in the amount of interest shown in it by any other in the exhibitions. Meanwhile, in the French capital preparations are going forward for an exhibition to be held the coming

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Fall to be devoted entirely to electricity and its applications. It will give brilliant illustrations of the present condition of the science, and will prefigure the progress to be looked for in the near future. The exhibition will be held in the Palais de l'Industrie, to which visitors will be carried on an electric railway. The trains will consist of two saloon carriages, and an electric motor which will take from the rails the fluid supplied by generators at the end of the line. In the center of the Palais will be a small pond in which a steamer will lay a submarine cable.

In the basement of the building will be illustrated all varieties of such cable and wire manufacture, adjoining but not forming part of the official portion of the exhibition, which will comprise all forms of government electric apparatus, manipulators, receivers, piles, telegraph posts, insulators, switches, and a thousand other matters of necessary detail in the complicated system of commercial or military telegraphy. Towering above the building will be an immense lighthouse carrying a light of great power. By daylight the visitors to the exhibition will watch the operations of a whole army of telegraphists, machinists, etc., while at night this swarm of operatives will be visible under the glare of a thousand electric lights streaming from the roof. It is intended to include among the illuminators every known burner, and a score or more are now known.

Among the "inevitables" of the exhibition we may look for fire-alarms, electric dials, municipal and police calls, etc. The railroad companies will show their signal systems, electric brakes and alarms and a new carriage for registering the velocity of trains, force of wind, consumption of steam, etc. The upper story has been devoted to scientific curiosities and fanciful inventions for the delectation of the curious but untechnical observer. Telephones will be connected with the theatres and the operas and the visitor to the exhibition will be allowed to hear the utterances and the music at any or all of the places. Connection by telephone will also be made with distant cities. Next will come a series of eight rooms, literal copies of a Parisian apartment of the present day, where everything will be, so to speak, run by electricity. The kitchen will be lighted by electric lamps; the range heated by electric currents passing through water; a half-dozen cooks, by means of incandescent platinum wires, will turn out waffles and cakes, and electrically heated metallic plates will serve for braziers and chafing dishes. The dining-room will be fitted out with all the wondrous new apparatus which already threatens our peaceful firesides with its novel blending of science and comfort. The central sunlight in place of a chandelier can be lighted by the pressure of a button or the opening of a door. The dishes will be brought up on an electric dumb-waiter. The only thing left to do would seem to be to eat by electricity, and, in view of the wonders accomplished, even that seems not so very improbable. The parlor will be furnished with electric chandeliers, mantel clocks going by electricity and adorned with electrical groups and figures, telephones and electric fire-places. In the billiard-room an electrical table will enable the player, if not to make his caroms, at least to mark them by an electrical indicator. The bed-room, besides all sorts of electric calls, will have electric hair brushes which will be made to dress the hair in a twinkling by press-

ing a button attached to the apparatus. Finally, a room will be given to electric views, projections and toys; miniature telegraphic apparatus, trick boxes, magic lanterns, railways, dolls and automata for the amusement of children. All this, strange as it may seem, is an actual fact, or will be very soon. Applications for space have been pouring in and the lists are now closed. The exhibition will be educational besides being very unique.—*Manufacturers' Gazette.*

A NEW FIBRE.

The Louisville *Courier-Journal* gives the following description of a new material for use in bagging and rope manufacture which has been exhibited in that city: "This beautiful, strong, clean fibre is produced from the plant known in this State as beargrass, and further south as the Spanish dagger. The family of Yucca contains about a dozen varieties, all stout, strong leaved plants, and has been used in Kentucky time out of mind for hanging meat while curing in the smoke-houses. This family of plants is known as a beautiful and abundant bloomer; long, tough, pointed fibrous leaves. The plant is omnipresent everywhere in the South, south of forty degrees north latitude. This plant is another item in the long list of the untold resources of the South. Its fibre is as strong as hemp or jute, and almost as indestructible as iron, except by the action of fire. Some of its advantages may be briefly summed up. The plant grows more than one hundred years; loses less than one-tenth in cleaning; it is the strongest coarse fibre in the world; will not shrink when it gets wet in rope; yields largely; requires no cultivation after the third year; is worth ten to fifteen cents per pound when cleaned, and grows spontaneously everywhere south of thirty-one degrees. —*National Scientific Journal.*

JAPANESE LACQUER.

The manufacture of lacquer, an industry for which the Japanese is deservedly celebrated, was made a special object of study by Sir E. J. Reed on his recent visit to the Flowery Land, and the following notes are mainly taken from his interesting volume:

"The Japenese lacquer is usually upon article of wood, and not upon articles of *papier-mâché*, as many suppose. It is produced from the sap of the *Rhus vernicifera*, which is taken in its natural state into a large wooden tub or vat, and then stirred in the sun with a large spatula, until its excess of water is evaporated. In some cases the varnish so produced undergoes careful straining; in other, it is mixed with sulphate of iron, with virmilion, with red oxide of iron, or with indigo; oil is sometimes employed, likewise powdered stone. Into some inferior varnhishes, a sort of paste made of rice enters in considerable proportion. There are a dozen methods of employing the various varnishes, differing according to the nature of the object to be produced. In the best lacquer, numerous coatings are applied, dried, and polished successively. The first polishings are done with

a stone named *tsu shimada* (suitable for hones), the latter by means of water, and a charcoal made from *Andromeda ovalifolia*, and the last with pulverized stag's horn. All the plishings are effected by the hand. When gold is used in smooth surface lacquers, where it is not to be in relief, the process is as follows: The design to be produced is traced on a leaf of paper, which is then reversed, and has repeated upon the opposite side of it the outlines and other features of the design, in a mixture of varnish and vermilion, softened over a mild fire. This side of the paper is then applied to the lacquer to be decorated, and the paper is then applied to the lacquer to be decorated, and the paper is rubbed and pressed upon it by means of a small spatula of bamboo. The transfer of the pattern from the paper to the lacquered surface is further assisted by gently beating the paper down with a small silken bag, containing powdered stone. The paper is then peeled off, and can be used again if desired. The slight relief of the pattern so produced upon the lacquer is rubbed down with carbon polish, and the design, and that alone, is then lightly covered with a thin layer of quickly drying varnish. Gold, in powder, is then applied to the moist surface by means of a camel-hair pencil if the gold powder be fine, and by means of a small tube if it be comparatively coarse and heavy. The article is then dried for a day in a warm closet, such as is used for drying the ordinary lacquer varnish.

"The design is next lightly cnated with a very thin layer of varnish, applied by means of paper steeped in it, and passed very delicately over the object, which is then redried in the closet. The object receives further extremely light coatings of varnish and subsequent polishings before it is complete. Silver is applied to designs in relief, the details of the process vary considerably, but the application of the metals is effected in substantially the same manner. When gold and silver are appied in leaf, they are laid upon the varnished surface prepared for them, and dealt with in the usual manner, the varnish acting as a "size" for the metallic leaf. When mother of-pearl is used as an incrustation for lacquer it is laid on during the varnishing processes, earlie, if it be thick than if it be thin, and the final polishing processes, earlier if it be thick than if it be thin, and the final polishing is proceeded with until the pearl is brought to the surface."—*Scientific American.*

A HINT ON ARRANGING FLOWERS.

Vick's Floral Monthly says: A new device for the arrangement of flowers consists of a piece of cork about a quarter of an inch thick, circular in form, and perforated with holes like the rose of a watering-pot. The diameter of the cork is made to correspond to the size of the saucer or shallow dish with which it is to be used. The cork floating on the top of the water supports the flowers, whose stems are inserted through the holes. For the display of small flowers and those having short stems this method seems well adapted; possibly it may be better than damp sand, though that is doubtful, but, as the cork may be preserved, it would always be at hand, and it might not be convenient sometimes to procure sand.

EDITORIAL NOTES.

THE editor of this magazine, having been prevented by severe illness and absence from home during the past two months from giving much personal attention to the REVIEW, desires to express his obligations to Prof. J. D. Parker and Mr. Samuel R. Hudson for valuable services in preparing and superintending its publication for September and October.

PROF. FAILYER, in the *Industrialist*, for September 24th, says, editorially, of the new Secretary of the State Board of Agriculture, of Kansas: "We feel confident that Secretary Coburn will be a success, and a worthy successor of Gray and Hudson every way. He has in him the thorough knowledge of the details of the Kansas farmer's life; and his reports, we are sure, will "come straight home" to the practical farmer of all sections of the State. Mr. Coburn has in him the energy and growth needed for the position."

THE Geographical Congress at its session in Vienna, awarded to the American section letters of distinction for various topographic and hydrographic surveys and publications by Government officials, and for a series of publications by the Post-Office Department; also a diploma of honor, second-class, to the Agricultural commission. Honorable mention is made of the Treasury Department reports.

WE have received from D. Appleton & Co. a copy of Tylor's *Anthropology*, which we shall notice in our next number. In the meantime we will call the attention of our readers to the full and interesting review of the book, in this issue, by Prof. Alexander Winchell, borrowed from *The Dial*, by which it will be readily seen that it is just such a work as all students of anthropology will desire to have.

THE Tenth Annual Report of the Kansas City Public Schools for 1880–81, is a volume of 132 pages and gives a most favorable and gratifying account of the progress made in the manner of and facilities for teaching, as well as that made by the pupils themselves. As it is a matter of local interest and every one who desires it can obtain a copy for himself, we give no details, but will simply congratulate our citizens upon having so competent and energetic directors, superintendents and teachers.

WE now have two first-class medical colleges in Kansas City; the Kansas City Medical College (late College of Physicians and Surgeons,) now in its thirteenth year and well known throughout the whole New West, and the Medical Department of the University of Kansas City, just commencing its career as an institution of learning. Both have Faculties made up from the very best medical talent in the city; both are erecting new buildings with all the modern facilities for teaching, and both, we sincerely hope, will receive sufficient patronage from the vast regions west of us, so rapidly filling up and demanding the best professional skill of the day, to cause them to succeed to the fullest expectation of their originators.

OUR fellow citizen, C. C. Hare, has invented and constructed a base burning, smoke consuming hot-air furnace for soft coal, which he styles the "Bituminous King." We have examined it with some care and believe that he has discovered the most correct and practical means of effecting the complete combustion of soft coal that has yet been presented to the public. This has been a great desideratum in the West and Mr. Hare deserves the congratulations and patronage of its people in the interest of economy and home thrift.

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WE were favored with a call from Prof. E. D. Cope, the distinguished Philadelphia naturalist, on the 10th ult., but unfortunately had just left town on a health trip to the Atlantic coast.

ITEMS FROM PERIODICALS.

THE October number of *Popular Science Monthly* concludes the nineteenth volume of this truly popular magazine. No scientific periodical in the country, if even in the world, has ever taken with the people as this has done and it is gratifying to learn that its subscription list is still gaining. $5.00 per annum is a very low price for more than 1,500 pages of such matter as is regularly furnished in the course of every year to its readers.

THE November *Atlantic* will contain, in the way of fiction, further installments of the two serial novels, and a short story of western life, by a new contributor. A charming paper by Mr. John Fiske; a discussion of the question, When did the Pilgrim Fathers land at Plymouth? by Mr. Sidney Howard Gay, and a reminiscence of factory life in Lowell, by Miss Larcom, will be prominent among the miscellaneous matter in this number.

THE November number of *Harper's Magazine* will contain, In Cornwall with an Umbrella, by W. H. Rideing, illustrated by C. S. Reinhart; A Week in a Dug-out, by W. W. Thomas, Jr., illustrated; Tilghman's Ride, a poem by Howard Pyle, based on an incident connected with the Surrender of Cornwallis, with illustrations by the author; Journalistic London,—the second of a series of papers by Joseph Hatton—illustrated by portraits and sketches; Ohio's First Capital,—a sketch of Chillicothe and of the pioneer history of Ohio—by Alfred Mathew—illustrated by portraits and views; The Land of the Midnight Sun, an illustrated paper by John Habberton, apropos of the publication of Du Chaillu's work bearing the same title; Ead's Ship Railway, by John A. Dillon, illustrated; a paper by Prof. John Fiske, entitled, How America came to be Discovered; the continuation of the two serial novels by Miss Woolson and Thomas Hardy, short stories, etc.

Van Nostrand's Engineering Magazine for October presents the following table of contents: Whirled Anemometers, illustrated; Note on the Friction of Timber Piles in Clay, by A. C. Hertzig, illustrated; Protective Works on the South Rangitata River, N.Z., by John H. Low; On Steel Castings, by Mr. Frank W. Dick; Hydraulic Mortars, by Dr. Michaelis; On Light Railway Locomotives, by Herr Von Borries; Theory of the Action of Railway Brakes, by E. Perron; Working of Light Railways on Common Roads, by Herr Buresch; The Dupuy Direct Process, Uniform Standard Time, by Sanford Fleming; The Projected Simplon Tunnel Through the Alps, by G. T. Lommel; The Goldschmid Aneroid, illustrated; The Art of Founding in Brass, Copper, and Bronze, by Edward Tuck; Theory of the Injector, by E. Herman; On the Maintenance of Pure Air in Dwellings; Gas for Light and Heating, by Dr. C. W. Siemens; On the Progress and Development of the Marine Engine; Determination of the Efficiency of Large Cylindrical Iron Tanks, by John D. Crehore; The Actual Lateral Pressure of Earthwork, by Benjamin Baker, illustrated; Paragraphs, Reports of Engineering Societies, Engineering Notes, Iron and Steel Notes, Railway Notes, Ordinance and Naval, Book Notices, and Miscellaneous.